

10a

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v.1

Order of Examinations - 1883-84.

	9 a.m.	5-8 p.m.
<u>Monday</u>	Obstetrics.	
<u>Tuesday</u>	Anatomy.	Nat. Medica
<u>Thursday</u>	Institutes.	Practice
<u>Friday</u>	Surgery.	
<u>Saturday</u>		Chemistry.

C. H. Brown, Chairman.

Wm. D. Thompson, Secretary.

C. H. Brown, Treasurer.

J. P. Brown, Librarian.

A. M. Cheston,

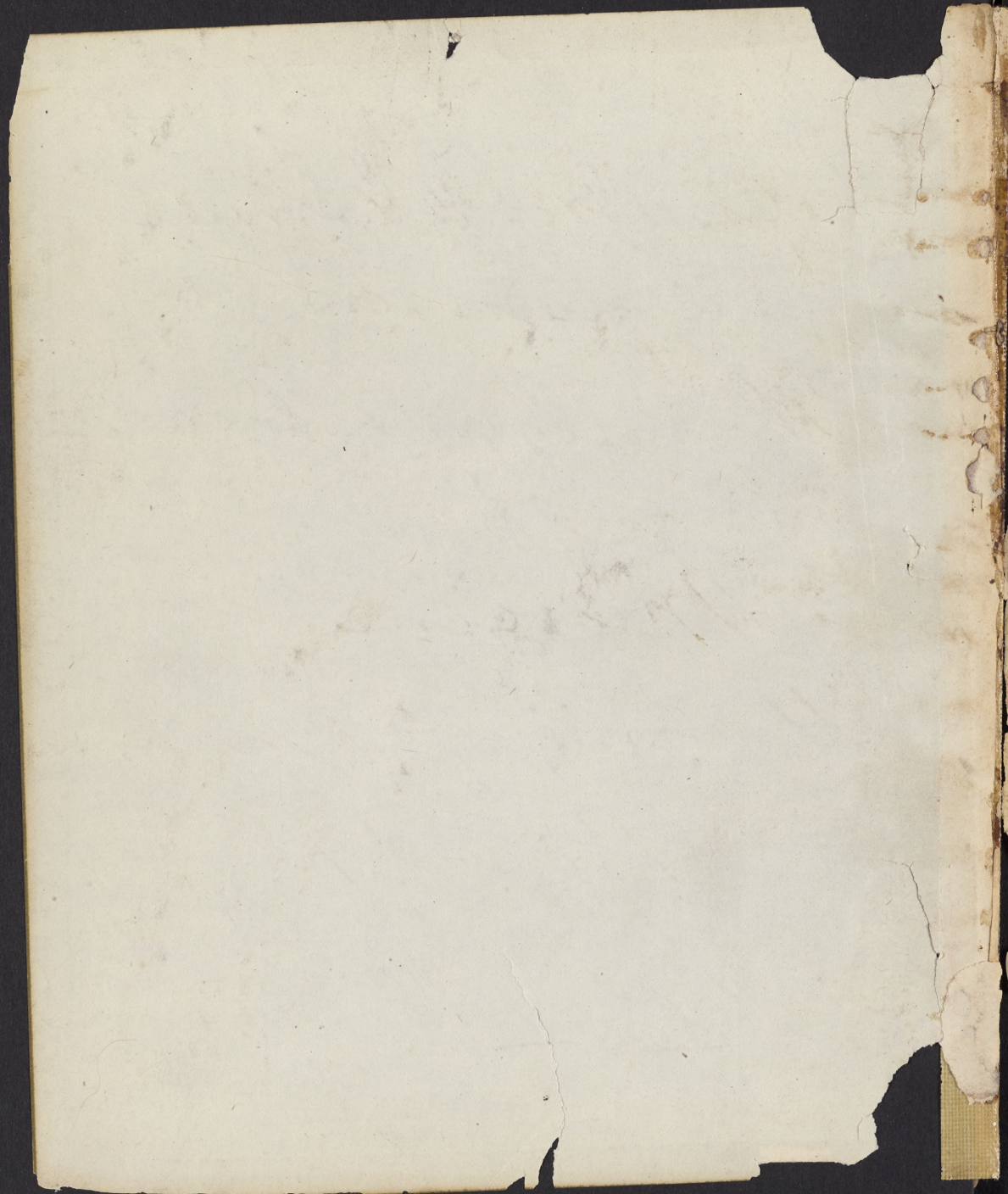
Notes on Prof. F. G. Smith's
Lectures on

"Physiology & the Institutes
of
Medicine"

University of Penna.

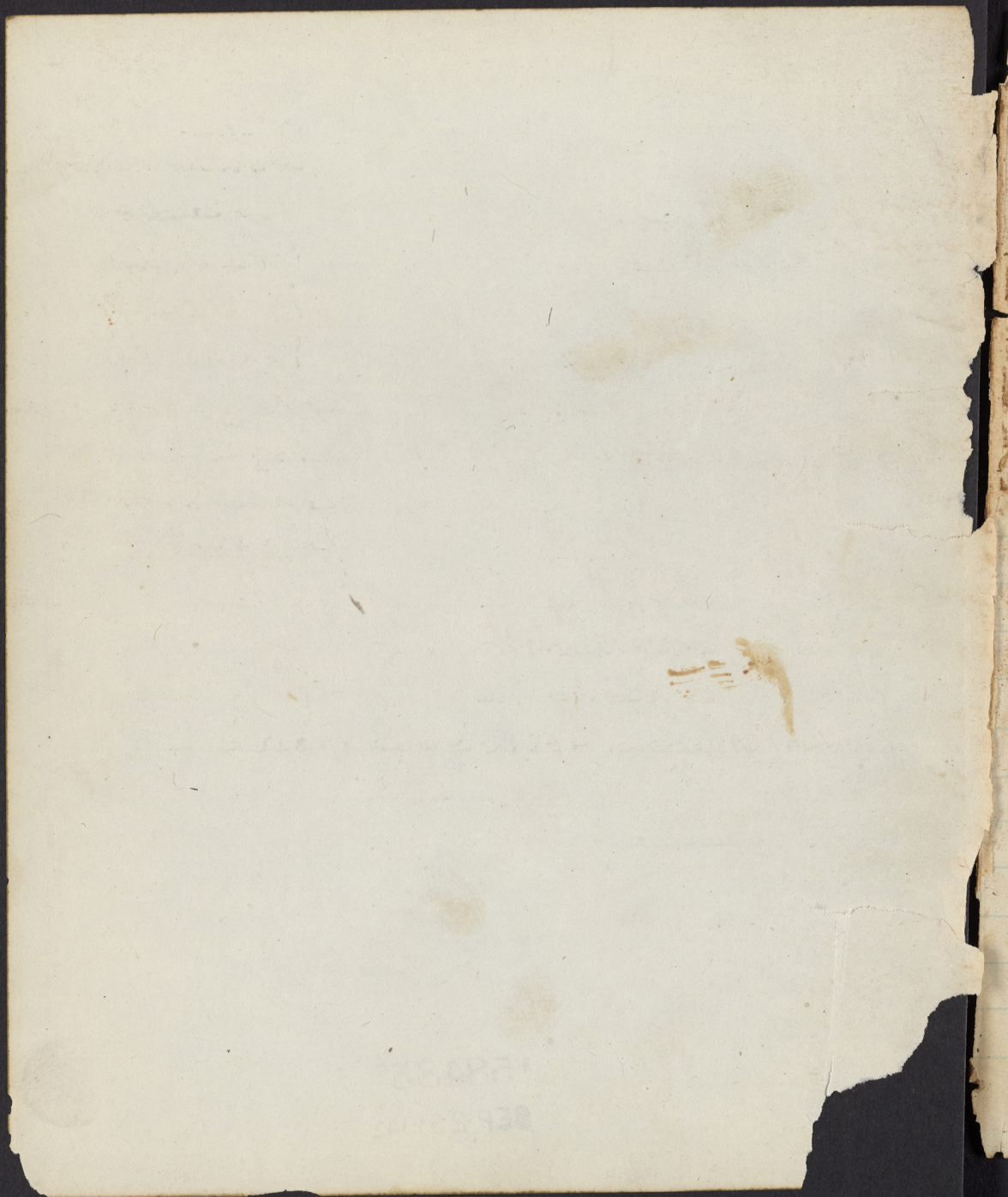
1883 - 84.

Vol. 1st



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Oct. - 14th - 1883.

Organic bodies

From a parent.

Duration - definite.

Shape - rounded.

Grows by int. deposit.

Size - determinate

Variable.

Tendency to decomposition.

Ternary or Quaternary.

Heterogeneous in structure.

Soft & elastic - generally.

Can be decomposed, but not recomposed.

Have power of Conservation & reproduction.

Can appropriate & assimilate.

Inorganic bodies.

Have no parent.

Duration - indefinite.

Angular in form.

By accretion.

Indeterminate.

Constant.

No such tendency.

Generally simple or binary.

Homogeneous or made
up of simple particles.

Hard & solid.

Can be decomp., or recomposed.

Can do neither.

Chemical constituents of Organic matter -

Oxygen }
Hydrogen } Essential
Nitrogen }
Carbon }

Sulphur }
Phosphorus } Non-essential

Chlorine

Fluorine

Potassium

Sodium.

Calcium.

Magnesium.

Manganese.

Silicon.

Iron.

Iodine.

Bromine

Aluminum.

Copper.

Institute of Med. - that branch which Treats of
The Laws of Medicine -

Functions of Organized bodies.

Generation.	} Organic or Vegetative.
Digestion.	
Absorption.	
Respiration.	
Circulation.	
Nutrition.	
Secution.	
Calorification.	} Functions of Relation.
Sensation.	
Vol. Motion.	
Mental & Moral Manifestation.	

Vegetable, Animal & human Kingdoms.

1st lives; 2nd lives & feels; 3rd lives, feels & thinks.

Vegetables feed upon inorganic matter generally,

Animals upon organic matter,

They all may move & may expire CO₂.

Oct. 17th - 13 - Prof. F. G. Smith.

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Manifestations of Cell life. a - Growth of the original cell, from its germ to its maturity. b - Multiplication by the subdivision either of the original cell or of its nucleus. c - Chemical transformation exerted upon the pabulum of the cell, whereby new products may be generated in its interior. d - Vitalization of a portion of the pabulum, whereby it becomes endowed with vital properties of its own, so as even to originate cells de-novo. e - Permanent changes of form, taking place in connection with acts of growth, and giving a peculiar character to the tissue. f - Impermanent changes of form, applies to the generation of mechanical force, and to the production of sensible motions. g - Production of nerve force, which may affect all the preceding operations, and which is intimately related to mental agency.

Classification of Tissues.

Ultimate physical Elements of Organized Bodies.

Primary physical form of Organic bodies.

Organic Cell.

Secondary physical Elements.
Tissues.

- I - Cells isolated or free corpuscular tissue.
- II - " aggregated or in laminae.
- 1 - adipose tissue. V - Cells forming tubes with fluid or Solids ^{Contents}
- 2 - Epithelial " 1 - Capillary tissue.
- a - Mucous. 2 - Muscular "
- b - Serous. 3 - Nerve fibres
- c - Epidermic. 4 - Dentine. ^{Substance}
- 3 - Glandular tissue. VI - Cells converted into a filamentous ^{Substance}
- 4 - Ganglionic " 1 - White fibrous tissue. ^{Column}
- 5 - Pigment " 2 - Yellow elastic " ^{Column}
- 6 - Anomalous " as Spleen etc. VII - Cells converted into a prismatic ^{Column}
- 1 - 1 - Enamel tissue. ^{Substance}
- 2 - Crystalline. ^{Substance}
- VIII - Cells converted into a corneous ^{Substance}
- 1 - 1 - Horn tissue
- 2 - Corneous.
- III - Cells with parietes blended & contents removed.

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Organized beings made up of fluids & solids. $\frac{4}{5}$ of fluid consists of water. $\frac{3}{4}$ of solids are water. Fluids most important ^{most abundant $\frac{2}{3}$ - $\frac{1}{3}$ of solids.} convey nutriment & carry off waste - give origin to solids. Haller reduced all tissues to fibrin. Still later they were asserted by Hodgkin to be derived from a vesicle - capable of respiration. Hodgkin exploded that theory. Schlieken & Schwann - 1838 - minute granules - "Cell doctrine". Was previously supposed that a granule was precipitated in blastema ^(or formative liquor) - aggregated others around it - forming nucleus & nucleolus - ~~the~~ membrane was thrown around it - forming nucleated cell. This theory is now exploded by Burchow & others. "Omnis cellula e cellula" - Vesicles of de Graaf - in the human ovum - has distinct cell wall, with nucleus or germinal spot - secondary cells formed by ^{by subdivision} it & finally, all the tissues of the body. Cell wall - contains Albumen - enclosed within it, fluid & granules - has power of osmosis & exosmosis. Has power of living in, & by itself - is an independent being. Grows & exerts power upon its contents - changes its form - permanently & temporarily. Contents possess motion - currents - causing wall to protrude. Sometimes causes excretion to live - spermatozoa. Develops new force.

Repair of tissues.

Formerly supposed to be dependent upon spontaneous cell development - granules contained in blastema. Now believed cell is found in connective tissues - areolar tissue - Virchow & Co. Become lighter up to increased vascularity - on injury or irritation they develop - divide & subdivide. More abundant in early life. Cell action concerned in every action of life. Fundamental unit, in all organized tissues.

Oct. 19th. Proximate principles of tissues & fluids.
1st Class - Inorganic, Crystallizable & derived fr. exterior.
Water, Chloride of Sodium (in all) Chloride of Potassium (in muscles, blood, milk, urine &c) Phosphate of Lime (in every tissue & every fluid) Carbonate of lime (in bones) Carbonate of Soda (in blood, saliva, lymph & urine) Carbonate of Potassa (in blood, saliva &c) Phosphate of Magnesia, Soda & Potassa (in the various solids & fluids)
The above are only a few of the 1st Class.

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2nd Class - Organic, Crystallizable & formed in interior.
Starch, Sugar & Alts.

3rd Class. Organic Substances proper.

Albumen } Proteinaceous. not crystallizable.
Fibrin }
Caseine }

Globulin, Pepsine, Pancreatine, Pyrine, Mucosine, Os-
tine, Cartilage, Musculine, Haematine, Melanine,
Biliverdine, Urosacine.

Physical properties of Tissues.

Elasticity, Flexibility, Extensibility, Endosmosis.

Proximate principles - any substance, simple or compound, ^(chemically separating) existing under its own form in any of the solids or liquids, from which it may be extracted without altering its chemical constitution - Phosphate of Lime in bone, Urea in urine. Every solid & fluid contains them - some of which are peculiar to it.

1st & 2nd Classes, of definite composition, - 3rd not so. Animals require a mixed diet.

{ The physical properties depend upon the molecular ar-
rangement of the tissue & are found as well in the
Dead as the living body, differing thus from vital.

Endosmose - Saline materials will infuse
out of albuminous solutions.

Endos. & Exosmose - Current is generally more rapid
from rarer to denser liquid. Diffusive power of tissues.

Endosmose common to vegetables as well as animals.

Make or current called endosmosis; - Stronger
Exosmose.

{ Oct - 21st Physical properties of tissues.

Flexibility, Extensibility, Elasticity & Endosmose

Vital properties { Formative force { development.
growth
Assimilation

Contractility.
Power of Conducting & Transmitting impressions.

Endosmotic action.

The liquids on the two sides must be miscible
& chemically compatible with one another.

The more elevated the temperature - provided
it does not decompose them - the more rapid is
the current. Motion increased rapidly.

Inorganic substances may allow it.

If the membrane becomes decomposed - or
if some particular chemical substances,
such as Sulp^h, Hydrogen or some of Salts

of Morphia be introduced into liquid - the action⁹
is arrested. This action seen in function of absorp-
{ tion - glass of water in stomach rapidly disappears.
Disease of mucous membrane or of blood vessels of part
prevent it. Plethora-venous impedes it. When vessels
{ are emptied it is increased. Secretions - some particles
of blood - Malpighian bodies separate in this way.
{ Nutrition - accomplished largely by Transudation in
this way. Dropsy - dependent on Exosmosis - Circu-
lation impeded - stagnates - watery & even albuminous
{ elements of blood are forced out, as in Ascites & anasarcom
swellings. Therapeutic application -
{ when blood vessels are full, absorption is impeded -
poisoned wounds cupped to produce congestion & im-
pede its absorption. Hydragogue Cathartics &c
deplete blood-vessels & promote endosmotic action
& absorption. Mourara - rapidly poisonous in blood -
{ fails to act in stomach fr. impeding endosmotic action.
Poison of Rabies ditto - like Smallpox.
{ Gaseous pass through membrane by same action -
in respiration we have Oxygen passing into vessels
& C.O₂ passes out. Takes place in Vegetables -
different plants take up particles most import-
ant to their Support & nourishment.

{ Certain Nervous Conditions prevent this action -
bas mus prevents it in Alim. Causal.

{ Vital properties - forces - acts.

Mind refers an action to an unknown cause.

{ causes force - Conditions under which it
acts constitute its law.

Vital forces include rather than exclude
physical force. Vital forces correlative

{ to one another - Nervous impression, trans-
mitted along fibre, becomes converted into Con-
tractility or muscular force.

{ Claimed by some that not only are physical
forces correlative to each other & vital forces
correlative to each other, but that some vital
are correlative to some physical forces.

Not a safe theory. Heat-aphysical force -
applied to unfecundated egg - produces only
lubrification. ^{The sperm must be present to produce a develop.} Repair of lost tissues - germ
force - "Vis Medicatrix Naturae".

Smith

Oct. 24th. Vital properties.

Formative force { Development.
Growth.
Assimilation.

Contractility.

Power of conducting & transmitting impressions.

Essential conditions of Life.

- I. A germ or nucleus endowed with life, derived only from a parent.
- II. The constant presence of food, or plasma in contact with the germ.
- III. A definite amount of water.
- IV. Oxygen in the proportion of the atmosphere.
- V. Caloric in definite quantity, but varying for different genera.

Life force manifests itself in 3 ways - in every organized being - animal & vegetable - formative force - Contractility & power of conducting & transmitting impressions.

The first means the power of appropriating & assimilating materials - manifested in 3 ways - Development or the original formation of an organ or tissue out of the original material, Growth - an increase of size - by an increase in amt. of constituent particles.

Assimilation - property of maintaining the original form & of converting plastic materials into tissue like the ^{producing} one.

The shorter the life of a tissue - the shorter the life of a cell - & the more active the cell - the shorter its life.

Every condition of life is death - old particles constantly being removed & new ones formed & assimilated by tissues in which they are deposited.

Contractility - power of moving under stimulus of an irritant - possessed by animals & vegetables; Intinct irrespective of nerve cell.

Power of Conducting & Transmitting Impression - Usually considered as peculiar to nerve cell, not so - proved by some sensitive plants (Mimosa pudica).

This life force is not self-acting - requires certain conditions - 1st "Germ or nucleus endowed with life, derived only from a parent." (See page 11) All of these conditions essential - abstraction of them produces death if persevered in long - "modification" ^{of type} produces disease.

{ Germ - an organized form - barely perceptible with highest power - Ovo-germ - in egg - develops living being; tissue-germ - develops tissue. The first-part of organization of matter - must be fructified in order to be developed. Spermatozoon of male coming in contact with ovum of female, proz

duces third body. It is part of organism of male 13
& may impart his peculiarities - like ovum & female.
In case of insect of rose-tree - several generations -
5 or 6 - are produced without fecundation - "partheno-
genesis"; seems to be exception to general rule, but
is not really so. Nature of male influence unknown,
probably adds something to ovum of female. Impres-
sion made on organism of female in one copulation,
often extend to second offspring - (famous running
mare & Quagga) Syphilis propagated by first
husband to children of second. Diseases in ovum
affect vitality in germ - Sterility - depending upon
diseased ovary. In germ, resides germ force, or
power of being converted into the peculiar tissue for
which it is destined, which lasts through life & im-
parts the same power to succeeding cells.

"His medicatrix Nat." - more powerful in young
than old persons.

{ Food - essential to life - seen to be as much demanded
for it in vegetable as in ^{or food} animals. Vegetable,
forms organized products from inorganic matter.
Modified food - depravation of it - modifies
blood - diminishes plasticity & produces disease
or death. Plasma, modified by interior causes
retention of secretions &c.

Hive of bees - illustrates power of modified food.

Queen bee - produced by feeding larva of
Common or worker bee on more stimulating
food - has organs of reproduction - different
wings - absence of hollow in thigh, where
they carry pollen.

Oct - 26th Vital properties cont^d

Reproduction.

- Non-Sexual
- Asexual
 - Fission
 - Parent splits; each part a new animal
 - 1 - Transverse, as in *Hydra viridis* (a polype)
 - 2 - Longitudinal, as in some *Volvox* (infusory)
 - 3 - Irregular, as in *Scinium pectorale* (")
 - Parent splits & discharges the young, as in *Volvox globator*
 - Budding
 - Budding upon the parent stock, as in *Hydra viridis*.
 - Separate buds, *Gemmae* or *Sporules*.
 - 1 - On all parts of the body, as in *Actinia medusa*.
 - 2 - On one part, organ only as in the *Aphrodite*.
 - Sexual
 - Amphrodite
 - Both sexual organs on one individual.
 - 1 - Self - {Impregnation} as in *Holothurica*.
 - 2 - Mutual - { " " } Earthworms.
 - Diocious
 - Oviparous; laying eggs which are hatched.
 - 1 - External {Fecundation.
 - 2 - Internal { " }
 - Ooviparous - Eggs hatched within the mother.
 - Mammiferous - Suckling the young.
 - 1 - Monotrematous, as in *Ornithorhynchus*.
 - 2 - Marsupial - Kangaroos, Possums.
 - 3 - Placental - or strictly viviparous.

Continued from last lecture. - Oct. 26th 18-
Water - gives fluidity to tissues - more found in
those tissues where most activity is required - Sup-
plies also O & H. Quantity of water in tissues de-
creases as we advance in age. Life is dependent
upon a certain amt. in body.

Certain animals become dormant or torpid, when
water is abstracted fr. it. Snail throws covering
over mouth & becomes dry without one supply of
water. Certain fish in India - affords another
example. Frogs - another, as well as lizards
& serpents - "boa constrictor". (Humboldt pitched tent
over alligator) Affords solvent for saline bodies
4/5 of body made up by it - 3/4 of solid com-
posed of it.

Oxygen - necessary to life in proportion of
atmosphere. Once thought to be the great vital
agent. Acts as great oxidizing agent & removes
effete matters. Air we breathe constantly being
contaminated by various gases - more especially
in cities. Ozone - from Greek word meaning "to stink".
Highly oxidized agent - find little in cities - used up
too rapidly. Found on sea shore largely - regarded by
some as H_2O_2 or peroxide of Hydrogen. Regarded
as a great source of Influenza - entirely want^d

in atmosphere when Cholera is prevalent.

Test - dip paper in solution consisting of Potass. Iod.

gr - Starch gr x in 100 parts of water.

Developed in Thunder-storms. Irritates Schneiderian mucous membrane.

Atmosphere contaminated by exhalation from bodies of men, as well as from lungs -

Hospital gangrene - Ship fever &c.

(Black hole of Calcutta) Exhalations cling to clothing, paper of walls &c contaminating air & producing disease in others.

260 - 300 Cubic feet of atmospheric air pass through man's lungs daily, & fresh air must be constantly supplied.

Caloric - Nature provides for its production in every organized body - by oxidation of Carbon & Hydrogen - Supplied in man by food & by Oxidation of Carbon - 3x daily; $\frac{3}{4}$ hydrogenized food required.

In cold climates more Carbon is required, as more escapes from his body.

Necessary to enable nerve force of life to be generated. Animal dies of starvation - more on acct of depur

ciation of temperature, than abstraction of 17
nutriment. Exhausting diseases, when temper-
ature falls - Use Alcohol - ^{intimately} to generate or liberate
heat & at the same time use such clothing as
will prevent escape of heat.

{ Heat is the active power of life, while
the form force is the radical power.

Excess of heat produces disease - blood will not
coagulate. All the above described ^{"essential"} conditions
of life - working together, constitute health.
Vegetables don't require functions of animal
life - since they live on inorganic matter.

Two circles of life - Organic & Animal - man
may be paralyzed as regards sensation & motion
& yet functions of organic life go on properly -
Some diseases have their seat in one circle,
some in the other,

Oct. 28th Special Physiology. Generation.
Reproduction or generation, that function
in living, organized beings, by which the species
is reproduced or perpetuated. Common to
Animals & vegetables. Non-Sexual re-
production, that which takes place
without influence of sexual intercourse.

{ See table on page 14. Two varieties of
Non-Sexual reproduction - 1st Fissiparous,
or by splitting ^(D.O.O.) generally longitudinal, some-
times transversely, - Sometimes irregularly.

No distinction of sex in Non-Sexual.

2nd, Gemmiparous - produced by little buds
or offshoots fr. parent. ~~fr.~~

Some of fissiparous animals have power of ^{re} produ-
cing themselves by means of eggs - causing "Alternate
generation".

Sexual reproduction - function is entrusted
to two sets of organs - when the two sets exist
in one body, it is called Hermaphrodite. They
sometimes have power of self-impregnation,
but sometimes mutually impregnate one another.

Diocious - Sexual reproduction in which it is necessary to have the two sets of organs in different individuals - two kinds - Oviparous, in which case eggs are laid & hatched - barn door hen; - Another variety of Oviparous animals - Eggs are fecundated exterior to body - as in frog.

Another form is Oo-viviparous - Eggs fecundated in body of female & hatched in passage through oviduct - Snakes &adders.

Another form of Diocious reproduction includes animals brought forth in living state & nurse by Mother afterwards - Mammals. Marsupial - a variety of above in which eggs are hatched in pouch, after passing fr. uterus - Opossum.

Placental - Eggs fecundated in body of female, ~~passing~~ resides in Uterus a certain length of time & then borne - Man - best example.

262 Theories of reproduction have been given. Spontaneous reproduction not now believed; Silicate of potassa - & Electricity thought to have been conclusive on the subject - in favor of it. Afterwards Knocked in head. Germ of acaris introduced into former.

Sexual reproduction.

Male pupans & sets free sperm cell; female pupans & sets free germ cell - union of two result in production of organism of new being. Precise part performed by two sexes for a long time unknown - Male supposed simply to quicken the substance produced by female. Both materials absolutely essential - doctrine of Epigenesis. Doctrine of Evolution supposes that one parent pupans are & affords it a resting place - only quickened by other sex. Sperm or semen - highly albuminous, alkaline. Contains granules - develops in vesicles of evolution or little cells. When vesicles are fully formed they burst & set out Spermatozoon & we see it floating in Seminal liquor. Spermatozoon has body & tail - latter vibrating. This unites with germ cell of female & produces new being. Reproduction in plants similar to that in man. Secretion of sperm begins at $13\frac{1}{2}$ or $14\frac{1}{2}$ year - puberty. Extends to $50\frac{1}{2}$ or $60\frac{1}{2}$ year.

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Macerate garment supposed to contain Spermatozoa
in warm water - but ^{followed} solution under frills of
microscope, will reveal them if there. May
find them in mucus of vagina - 4 or 5 days after
copulation.

During

Oct. 31st - Conclusions in regard to the Ovarian theory of Men- Stratton

- I - Menstruation is a periodical function of the ovaries.
- II - Ovulation is a constant function of the ovaries.
- III - Ova are matured in the ovaries at all ages, but more rapidly during menstrual life.
- IV - Ova are discharged at all periods of life, in the intervals as well as at the time of menstruation.
- V - Ovulation & menstruation being often concurrent, indicate that they are both the result of the attainment of a certain point in the development of the female economy.
- VI - The law of periodicity in the one, not obtaining in the other, leaves still wanting the inseparable link in the chain of causation whereby menstruation can be shown to be the effect of ovulation.
- VII - At the menstrual period, the ovaries experience an extension of the uterine congestion & become equally with the uterus, the seat of increased functional activity.

Menstru-

VIII - The menstrual flow is a true hemorrhage, as shown by chemical analysis & by the phenomena of disease.

IX - Menstruation & the elimination of vesicles are equally functional phenomena of the ovaries - this action in the healthy non-gravid or lactating woman - sustaining a periodical exaltation of power which extends to the vascular, nervous & absorbing tissues of the ovaries, occasioning menstruation & the discharge of vesicles - & to the uterus & vagina - giving rise to the extrusion of deciduous vessels & the menses.

Testis of man descends about eighth ^{month} week of embryonic life. Man deprived of them loses hoarse voice & talks like female.

Ovary - has peritoneal & fibrous coat - the latter tunica albuginea. Stroma of ovary - fibrillar in character - between its meshes - are found Graafian follicles or vesicles, each one having two coats - outside, vascular - derived fr. stroma; - inner one - constitutes ovisac. Within ovisac - have membrana granulosa - pavement epithelium.

Interior of ovisac - have ovum proper.

surrounded by Zona pellucida - or vitelline membrane;
 have tunica granulosa around it. Commu-
 nicating with Zona pellucida by tenacula.
 Burst the ovum we have gelatinous yolk
 or vitellus - in this we find the formosissimum
vesiculans - being perovineal vesicle, within
 this, the germinal spot.

Have development of all the organs & functions
 as well as sexual characteristics better shown
 at period of puberty or of functional activity
 of reproductive organs. This period compares
 to that of flowering of plants. The two sexes seem
 to diverge fr. each other at this period - but come
 up to it & go "down the hill" together afterward,
 hand in hand. Sexual characteristics
 depend upon the presence of reproductive
 organs. Flow takes place every 28 days
 fr. females - an anast. of regular periodical
congestion on the generative organs - blood
 is like venous; a true hemorrhage.

Has been supposed to be due to pent. plethora,
 to lunar influence & to Ovular theory - or
 to the development of ova. Ovum approaches

wall of ovary every 28 days recedes - causing congestion & slight hemorrhage. They say, if female is exposed to influence of sperm - 8 or ten days after menstruation, she is impregnated, if it be delayed longer - she is not. If female can conceive without menstruating, this theory don't hold good & this is known to be the case. Israelitish law didn't allow female to be touched for fourteen days - after menstruating & yet they then conceived.

Every menstruation is attended by ovulation, but D. S. - thinks the latter is rather dependent upon the former, than vice versa. He thinks a periodical congestion takes place for the purpose of preparing the organs for a new being.

"These phenomena are coincident & don't stand in the relation of cause & effect," if they do, it is as above supposed.

In the lower animals there is an escape of ova at period of heat.

Nov 2nd Reproduction cont^d - Menstruation.

Changes taking place ^{in ovary} after escape of ovum.

Corpus Luteum of Menstruation } Uterus of Pregnancy.

At end of three weeks	Three-quarters of an inch in diameter; convoluted wall pale	in diameter; central clot reddish
One month	Smaller - convoluted wall bright yellow - clot still reddish.	Larger, convoluted wall bright yellow; clot still reddish.
Two months	Reduced to the condition of an insignificant cicatrix.	Seven-eighths of an inch in diameter, convoluted wall bright yellow; clot perfectly decolorized
Six months	Absent.	Still as large as at end of 2 nd month; clot fibrinous; convoluted wall pale.
Nine months	Absent.	One-half an inch in diameter; central clot converted into a radiating cicatrix; the external wall tolerably thick & convoluted, but without any bright yellow color.

Graafian follicle first formed - then germinal vesicle, then yolk around this & outside of all vitelline membrane - Size of ovum from $\frac{1}{40}$ - $\frac{1}{20}$ of an inch; germinal vesicle $\frac{1}{800}$ of an inch; the escape of ova take place about puberty from 12 - 14 yrs. of age in this climate. Habits & place of residence affect the period at which menstruation & puberty appear. Not more than two or three

years difference between Laplanders & residents of warm climates. Ova may escape entirely irrespective of Sexual congress.

Menstrual period not analogous in all respects to period of heat in lower animals; human female not inclined to copulate just at period of menstruating - female of lower animals is. Seems to be a periodicity about male also - some ^{male} animals put on their most pleasing appearance at certain seasons & a Congestion of Sexual organs take place at same time & even in human male this may be observed; especially seen in men of delicate health.

Object of menstrual flow - Described as "a disappointed effort on the part of the uterus to form a deciduous membrane". Nid - thinks it is to prepare the Uterus for ~~pen~~ception.

A little opening found on surface of ovary after menstruation - Ovi-sac becomes hypertrophied & on the int^l a granular deposit takes place called Corpus luteum. The membrane lining ovi-sac then

becomes arranged in folds, in consequence of its being hypertrophied - finally filling up entirely the ovaries & sometimes the granular material becomes forced out. Corpus luteum once supposed to be positive evidence of pregnancy, but now known to take place at every menstruation.

When the ovum is fecundated, - the corpus luteum (being then the C-l- of pregnancy) becomes larger, being analogous to reflex irritation from uterus. That of menstruation does not continue to grow after 3rd or 4th week, while that of pregnancy continues to grow till end of pregnancy. The difference between the two is one of degree not of character. It may be deceived by large size of that of menstruation or by small size of that of pregnancy - See table - page 25.

True & false corpora lutea are bad terms. One supposed to occur before escape of ova. Also unknown. Ovum is grasped by Fallop. tube - fimbriated extremity - by a sort of reflex irritation & is carried down to uterus. If ovum meets with sperm cell it becomes fecundated - which consists essentially in the mutual action of two essentially different cells - male & female.

If it is not fecundated it escapes with menstrual flow. It is said that sperm cell gets in to germ cell through the micro-pyle.



Sto^r 4th Fecundation.

Once supposed to have taken place by ner-
vous agency - by sympathy - by halitus, or
a vapor arising fr. male or sperm cell. Experi-
ments have proved them to be false theories,
& positive contact is known to be necessary.

(Gentleman with hypospadias) ^{injects sperm} a change in
the color of ovum takes place as soon
as sperm cell is brought into contact (Fishers
men observed it in raising fish - Trout)

Contact takes place - supposed by some -
in Ovarium - but objections - cell can't pass
through walls of Ovary - when it does it is the
exception rather than rule. Peristaltic

Movement of Fal. tube - fr. above doubted?
another objection; ciliated epithelium of ^{fr. ovary}
same tube moves in opposite direction,
another objection. Ovarian impregnation.

not probable - fecundation - or Union takes place
 low down in tube or in uterus. It is an organic
 action - can take place without knowledge or con-
 sent of female. Spermatozoon must be living;
 it is the vehicle & vital agent of fecundation.
 New agents & vital influences formed in the
 contact. It is probable there is a micro-pyle
 in ovum, through which spermatozoon gets in-
 to germ. Spot & they ~~then~~ both disappear on
 Union. If the ovum - fecundated - attaches
 itself to its mother we have Conception - the
 latter name being applied to the fixation
 of the new body. A deciduous membrane
 is formed in uterus - so named fr. its being
 cast off at each parturition. Changes in
uterus - a number of little glandular
 orifices are seen on mucous membrane
 of uterus. Some of the glands are tubular,
 some convoluted. Interfollicular spaces con-
 tain bloodvessels. Under stimulus of uterus,
 increased quantity of blood is rec^d here & the
 glands throw out an abundant albumi-
 nous secretion. The ovum coming down,

chorion,
surrounded by membrane, with villous
prolongations - these insert themselves
into orifices of these glands & thus derive
nutriment. This membrane ^{surrounding prolongations} becomes
The deciduous membrane. ^{vera} This be-
comes enlarged by granulations & surround-
ing the whole ovum - forming decidua
reflexa. The two deciduous membranes
differ in character - the first being an
altered condition of lining membrane
of uterus, & the latter a new formation.
When the germ & sperm cell unite & dis-
appear, there is a new cell formed -
soon being divided into two - by fissure
or splitting of yolk - each half con-
taining germinal cell - they go on
multiplying by subdivision - each
mass containing a germ cell. From
these cells are formed every organ
& structure of the body.

Nature of fecundation - the properties
of germ depends upon the character
of both parents - Shown in mules &
& mules. Children born after death

Nov 7th Classification of Aliments.

Prout.

Aqueous, Mucilaginous.
Saccharine. Amylaceous.
Lignous. Pectinaceous.
Acidulous. Alcoholic.
Oil or fatty. Proteinaceous.
Gelatinous. Saline.

Magendie.

Farinaceous. Mucilaginous.
Sweet, acid. Oily or fatty.
Caseous. Gelatinous.
Albuminous. Fibrous

Liebig,

Nitrogenized or Plastic elements
of Nutrition.

Non-nitrogenized elements
of Respiration

Vegetable Albumen.
" Casein.
" Fibroid.
Animal flesh & blood.

Fat. Pectine.
Starch. Passarine.
Gum. Wine.
Cane Sugar. Beer.
Grape Sugar. Spirits.
Sugar of Milk.

Prout (modified)

Saccharine, Oleaginous, Albuminous, Aqueous, Gelatinous (?)
Cane Sugar. { Fats. Meat, Eggs. Solutions & infusions in water.
Grape " { Oils. Milk, Bread. Nutritious Vegetables.

Accessory Diet.

Alcohol, Tea, Coffee, Salt, Spices, Tobacco, Opium,
Indian Hemp, Flavoring Ethers, Essential oils,
Cacao (not Cocoa)

Food.

Digestion is that process by which alimentary matter is reduced to such a condition that nutritive materials may be removed fr. it.

Man consumes & requires a ton of food a year.

Man's weight varies little - "paym^t = equals rec^d."

Food requires for three purposes - "1st for building up a new tissue - 2nd for repair - 3rd for generating heat. Influence of diminished suppl, not same in every being - deprivation of food in animals cause disease - but over suppl, don't increase their size proportionally; In vegetables it does. Vegetables live on inorganic matter - Animals too in some cases, but generally on organic. "Wherever organic food exists there is an animal to consume it" - (Hippopotamus at bottom of river - Giraffe for tall trees). Flourishment of plants derived fr. air & earth, - CO₂ principally, & some Ammonia being their food. Vegetables absorb exhalations fr. bodies of animals & keep up purity of atmosphere. Fungi feed on organic matter. Some animals, as earth-worm appear to feed on inorganic matter, as dirt, but organic matter exists in this dirt.

November 9th Food & digestion cont.

Being act attended with loss of substance, making demand for food as repairer.

Man wastes 1 ton per year & requires as much - Oxygen, food, water &c.

Food is required to supply heat - for the temperature of the body is low in inanition - animal heat small in quantity. About $\frac{4}{5}$ of our food required for Calorifying purposes.

See Classification of food on page 32.

Liebig thinks his first classification alone histogenic & that the second are necessary to supply animal heat & therefore go to supply Respiration; but some of these last may be histogenic, & so may some of first supply heat. Therefore his Classification is imperfect. Oxygen too is necessary for modifying nutrition & yet he places most of it under the head of Elements of Respiration.

Prout's is the most philosophical Classification - human milk & any milk contains nearly all of these - Saccharine, Oleaginous, Albuminous & Aqueous matter. Dr. S. thinks Gelatinous articles of food unnecessary & useless as articles of food, except possibly through the Hydro-Carbonaceous matter they contain, which may become oxidized.

Life can not be sustained for a long time on any one class of food. Have bilious disorders fr. living too long on Oleaginous matter, Dr. Hammond M.D. experimented on himself with all kinds of food & found Albumen in his urine when living on that article.

(Arthritic diseases are caused by living on Albumen - being converted into Creatin, Creatinine & then Uric Acid, which is abundant in the blood of Gouty patients.)

Dr. H. - found Sugar in his urine on living on sugar, & that nearly all the Gum he consumed, when living on that article, was passed off in the excretions, showing that it is not nutrition. Excessive use of Amylaceous

food gives rise to Acute Articular Rheumat. fr. being converted into Dextrin, then into Grape Sugar & finally into Lactic acid, which is Thrown off by Serous membranes. A deficiency of any of these Articles also gives rise to disease - That of Oleaginous Articles gives rise to Scroph-ula & Phthisis.

Must have an increase of Albumin-ous food when taking active exercise in Temperate Climates - Add Oleagin-ous matter in Cold climate & lessen it in hot climates.

Accessory diet - See bottom of page 32. Not essential to life. Generally combined with water, which is neces-sary to life in certain quantity. When it is taken in excess - Urine & perspi-ration are increased, & matters are rap-idly washed out of system. If food can be taken comfortably in proportion, the patient's health is excellent, but if food can not be obtained, it is hurtful in such large quantity.

Alcohol - (Dr. S - a temperance man.)

When taken in proportion of $\frac{1}{3}$ to 3 or 4 times a day, there is a diminution of waste of tissues, of urine & of fecal discharge.

Body increases in weight if usual amt. of food is taken. Prevents rapid metamorphosis of tissue - hence useful in small doses in persons of feeble digestion. All food goes to the production of force of some kind; Alcohol becomes converted into heat & is thus productive of either muscular or nervous force.

All these articles of necessary diet go to prevent the rapid metamorphosis of tissue - when not used in excess.

Salt assists in the liquefaction of albuminous materials & hastens metamorphic changes.

Nov 11th Composition of Saliva.

Water -	995.16
Organic Matter -	1.34
Found nowhere else in the body. Sulpho-Cyanide of Potassium -	0.06
Phosphates of Soda, Lime & Magnesia -	.98
Chlorides of Sodium & Potassium -	.84
Mixture of Epithelium	1.62
	<hr/> 1000.00 (Fornichs)

Quantity of Saliva absorbed during mastication.

Kind of food employed	Quantity of Saliva absorbed.
For 100 parts of hay -	There were absorbed 400 parts of Saliva
" " " " barley meal, " " "	186 " " "
" " " " Oats - " " "	113 " " "
" " " " green stalks " " "	49 " " "
" " " " leaves " " "	

(Lassaigne)

Milk contains at first a smaller amount of Casein than later, as infant has less "wear & tear" of tissue at first than later in life.

Digestion. - The first step is prehension, or taking of food, observed in animals & vegetables - leaves of plants brought into contact with their nutrient by waving, & plants & animals fixed to the earth have tentacles

as prehensile organs & they have a glutinous substance on them, thus entangling articles; they then close in towards mouth. Some animals surround their food or prey - some seek it by force, some by fraud; - Man by all these. A guiding sensation is necessary for prehension.

Mastication - the 2nd stage of digestion.

Organs of mastication in stomachs of some animals. In higher animals it takes place in mouth & different animals have different arrangement of these organs - different movement of jaws & different arrangement of teeth.

The Stomachs too are different, being more complex in herbivorous animals.

Food reduced to fine particles by mastication & by constantly revolving it, is brought into contact with the Saliva. Tongue - accessory organ of mastication - acts as "hopper-boy" of mice.

Parotis glands, submaxillary & sublingual glands pour secretion into mouth & assist in mastication, as well as glands of cheek & tongue, ^{and}

This secretion being Saliva - a complex fluid. (See page 38.) Sulpho-Cyanide of Potass. of Saliva being swallowed & a per-salt of Iron being in

Stomach, a red color is produced, which may be distinguished fr. that produced by HCl = Conic acid & Iron by Corrosive Sublimate in the first preparation destroying the red color when formed - not so in last.

1005 - Sp. fr. More alkaline during mastication. Starch is converted into glucose by Saliva.

Secretion of parotid gland - thin & watery
" " Sub. Max. " thick & gelatinous.
" " Lingual " thin.

The glands of the different sides alternate in action.

Secretion of Sub. max. gland coats bolus when it is to be swallowed with gelatinous fluid. Food mixed with Saliva is found to be more perfectly digested than that mixed with water.

Quincy

Nov. 14th. Composition of Gastric Juice.

Water - - - - -	975.00
Organic matter - - -	15.00
Lactic Acid - - - -	4.78
Chloride of Sodium - -	1.70
" " Potassium - - -	1.08
" " Calcium - - - -	0.20
" " Ammonium - - - -	0.65
Phosphorus of Lime - -	1.48
" " Magnesia - - - -	0.06
" " Iron - - - - -	0.05

Secretion of any one pair of Salivary glands doesn't convert starch into glucose - requires them all combined; probably ptyalin is what acts on it. It is said that Choleraeum virus on any mucous membrane & that any alkaline substance will have the same effect on starch. Secretion of Sub. max. gland is profuse in idiots & per-
verts thus choking. Act of mastication is a voluntary one - brains of 5th & 7th preside over it - but may be performed automatically, when mind is engaged. De-glutition -
3 stages - 1st voluntary & attended with sensation, takes place in the mouth - bolus be-

ing collected fr. all parts of mouth, the tongue
presses it back to ant & half arches; then
the 2nd Stage takes place - tongue is drawn
further back, larynx rises, epiglottis
pressed down, the breath is held & bolus passes
over; this stage is involuntary, but sensa-
tional. These actions may take place without
any volition - as in anencephalous infants -
through reflex action. Glossopharyngeal
is afferent nerve, ^{& fibres of 8th & 9th} presiding over this.

Suplt, middle & inferior constrictor mus-
cles of pharynx, contracting force bolus
down. 3rd Stage - food is in Esophagus -
involuntary, & unattended with sensation.

Mucous lining of Esoph. larger than
warts. Muscles at upper part - Stric-
tured; those at lower part involuntary & con-
tract peristaltically & slower than those
above. Pneumogastric supplies some
fibres to esophagus - if it is cut the food
doesn't pass into stomach.

Bolus too large or too hot gives pain in
Esophagus. Stomach - an elongated
curved pouch - Cardiac & pyloric

orifice - sphincter at latter orifice. Ext^l & cont-
 peritoneum, then muscular, then mucous cont-
 internally. These sets of muscles - ^{involuntary} first run longitu-
 dinally - 2nd circularly, 3rd obliquely. Mucous
 membrane layer than walls. Peristaltic
 action of muscles. Glands - some secrete
 mucous, some gastric juices.

Open in reticulated spaces by small orifices at
Cardiac orifice end. At pyloric end, the mu-
 cous membrane forms villi. Comp^d gastric
 glands - at Cardiac end & greater curvature.
 Their branches are shorter at pyloric end -
 proper secretion of stomach probably formed
 by these glands, while the simple glands secrete
probably pepsine.

Intestinal tract very short in carnivorous ani-
mals; Stomach of herbivorous animals very
 complex, Sheep has 4 stomachs; the fourth is
 the only digestive one & the only one lined with mucous
 membrane. Camel's stomach arranged on same
 principle - first reticulated to hold water & these
 cavities are closed by muscular fibres.

Nov 16th Composition of Pepsine.

Carbon - 530.00

Hydrogen - 67.00

Nitrogen - 178.00

Oxygen - 225.00

See page 48

Digestion. Food is not properly inside the
body until it has been removed fr. the stomach.
When food enters stomach a peristaltic
movement takes place - sending it along
greater curvature to pylorus - along lesser
curvature back to Cardiac orifice.

These movements excited by - not dependent
upon pneumogastric nerve.

Peristaltic action takes place even for a
short period after death. Muscles of stomach
contract more powerfully in middle of
organ & at pylorus than at other end.

Mucous membrane becomes very red
& alkaline - disappears when food reaches
it. Gastric juice - viscid, acid & of a
sp. gr. of 1.010 is poured out. It is secreted
principally near the pyloric end - as proved
by Bernard's experiment with Lactate of Iron
& ferrocyanide of Potass. injected into veins.

Gastric juice - owes its acid reaction to
 (Maintained by some to be dependent upon Hydro-chloric
 & others upon Lactic acid; Dr. F. B. Smith & R. E. Rogers
 tested it in St. Martin's case a few years ago, by introducing
 different substances & removing them through the fistulous
 orifices & determined that it did not depend upon Phos-
 phoric acid, that if Hydro-chloric acid were present
 it was in very small quantity & that the acid reac-
tion depends upon Lactic acid.) the presence of
Lactic acid is a great measure. Pepsine is
 necessary to hasten the solution of substances in
 the gastric juice. (For Composition see page 44.)
 This exists in abundance in 4th Stomach of Calf;
 commonly called rennet; may be obtained by
 macerating pig's stomach in water - pour off
 first water & after dissolving some time, evapo-
 rate or precip. by Plum. Acet. & you get it as
 a white powder. Probably pepsine is secreted
 by different glands fr. those secreting gastric
 juice - probably those at Cardiac End of Stomach
 acts by Catalysis. Pepsine given in some
 cases of Dyspepsia - Rx - XV at meal times
 on bread. There must be proper tempera-
 ture of Stomach - 98° or 9° when empty.

100°-101° when digestion is going on. Cut
Pneumogastric nerve when digestion
is going on & the operations of Stomach are
at first suspended, but afterwards go on
again - Showing it is influenced by, but
not dependent upon nervous influence.
Quantity of Gastric juice necessary
to digestion is larger than that of food
required - Dalton found 16 lbs necessary
in dog to dissolve one lb. of meat; the
External part of the food is dissolved
first, consequently all this gastric
juice is not present at any one time.
But no more gastric juice is poured
out than is necessary to dissolve suf-
ficient food for the sustenance of life.
Acids taken into Stomach diminish the
quantity - & so does high temperature.
Alkalies hasten or increase its secretion.
Ice at first arrests it secretion.
The Albuminous substances only
(of Prout - see page 32.) are affected by
the digestion above described; they are,

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by it, converted into albuminose, which is not precipitated by heat or HNO_3 & undergoes endosmosis rapidly, thus differing fr. Albumen. This endosmotic absorption takes place rapidly at pyloric end of stomach. A solution of Albumin injects into blood vessels is passed off unchanged fr. kidneys. A solution of Albuminose injects into circulation is rapidly absorbed. Amylaceous, Saccharine & Chapeinose articles are simply dissolved by it; the first may undergo a certain amount of change.

Nov 3, 18th Composition of pancreatic fluids of the ass.

Water.	—	—	—	985.40
Solids.	—	—	—	13.60
Fat.	—	—	—	<u>1000.00</u> 0.26
Alcohol-Extract.				0.15
Water Extract - Albuminous.				3.09

Alkaline	{ Chlorides Phosphates Sulphates }	— — —	8.90
----------	--	-------	------

Carbonate & Phosphate of lime & Magnesia	—	1.20
		<u>13.60</u>

Length of time required for solution of food in stomach depends upon Soluble character of food - generally fr. 2-5 hours.

Length of time doesn't depend upon nutritious quality of food. Some substances retard digestion - Alcohol in large quantities does.

When fibrin, albumen or Casein is introduced it is dissolved & converted into albuminose; this is absorbed & taken into circulation.

(Brown-Séquard - swallowed rapidly a portion of cooked starch & on vomiting found glucose in it - so that it is to a certain extent affected by gastric juices.) Both orifices of stomach closed during digestion. Gentle exercise hastens digestion.

|| Digestion is not putrefaction - gastric juices is antiseptic; it is not decoction, the temperature is too low - 100° . It does not consist in grinding or trituration of food - lining of stomach too smooth. It is not fermentation - no gas is given off.

|| It is a chemical solution - hastened by

fine division of food & rapid movement of food fr. 49
side to side in stomach. If we add more food than
will make a saturated solution, the surplus
is not acted on. The secretion of the gastric
juice is the only vital action in the process.
The gastric juice acts on the walls of stomach
itself after death - the vital protective ac-
tion being then withdrawn.

Vomiting - Stomach contracts in vomiting,
cardiac sphincter relaxes, if it don't we have retching.
It is preceded by nausea, - regurgitation is not.
In the latter case the food lies "banked up" in the
cardiac end of stomach & in some people can be
brought up voluntarily, without nausea.

Eruetation characterized by gas being brought
up owing to imperfect digestion.

{ Hunger, an int^l sensation, usually referred
to stomach & demanding solid food. Thirst
an int^l sensation demanding liquids & referred
to fauces. Hunger not dependent on action
of gastric juice on stomach - for there is
none there at the time. It doesn't de-
pend on the friction of the walls on one
another, but on the condition of the

Gastric blood vessels - a congestion, caused by sensation conveyed fr. General system through Great Sympathetic nerve. Any substance, soluble or not - then introduced caused secretion of gastric juices, relief of congestion & temporary relief of hunger.

{ Thirst depends upon emptiness of bloodvessels - may be relieved by tepid bath or by injection into blood vessels. (often relieved in Cholera by injection of Salines into blood vessels.)

{ Phenomena of Starvation -

Early stage = hunger, nausea & sinking at stomach - then excessive thirst, failure of strength, glassy eye, emaciation, fetid, brownish oozing on surface of body; bodies rapidly decompose after death, effluvia ^(resulting from decay & tear of tissue) materials, ordinarily removed fr. system during health are not here removed & give rise - by their emanation, to zymotic diseases - hence famine & pestilence often coincident,

Whenever there is defective elimination fr. sys-
tem of effete material, Zymotic diseases
are common. Puerperal women - fr. rapid
breaking down of muscular tissue of uterus,
this being retained for a longer or shorter pe-
riod in blood vessel - are liable to puer-
peral fever & zymotic diseases. Anything
which causes great "wear & tear" of system,
causing blood vessels to be loaded with ef-
fete muscular tissue, will render us more
liable to disease.

Fat undergoes most rapid absorption
in starvation - 90%.

Blood - 75% - Muscular system 40% -
Nervous system 1%.

Man may take in 24 hrs (generally does)
about 0% - food. Smallest amt capable
of sustaining life is about 0% 12.

Esquimaux may eat 25 lbs per day.

Quint:

Nov. 20th Intestinal digestion.

Only one class of food as yet digested - Oleag-
inous & Amylaceous matter digested in
intestines - between pyloric & ileo-cecal
valves. Calorific digestion more
properly. Albuminous food not absorbed
fr. stomach, is here taken up too.

Muscular fibres - involuntary - Circu-
lar & longitudinal - contract slowly
& peristaltically. Intestine shortened & con-
tracted alternately. Movements influenced
by but not dependent upon nervous
influences. Slower than in stomach,
except after purges. When contract
too slowly have constipation - same
thing occurs when secretion is too
scarce. Mucous lining - longer
than other coats - thrown into folds -
valvula conniventes; they present a
larger surface for secretion & absorption
& delay passage of feces. Jejunum
generally found empty fr. rapid movements.
Ileum more twisted than other
parts.

Brunner's glands - in duodenum - like salivary glands - racemose; function like salivary glands. Lower down - 4-5 inches - ducts of liver, ~~liver~~ - "Ductus communis Choledochus" + duct of pancreas - empty into duodenum. In some animals the latter empties lower down. Follicles of Lieberkühn empty into small intestine throughout its entire length - mucous secretion. Peyer's glands ^{everywhere} in ileum - closed follicles - Solitary glands - apprinalis in ileum.

Secretion of Brunner's glands convert starch into Dextrin. That of liver - bile, greenish yellow, bitter, alkaline. (70% discharged per day.) Secreted in intervals of digestion - 12-14 hrs after taking food - & is contained in gall bladder. Bile throws down precip. on reaching albuminose - neutralizes its acidity - stops gastric digestion & forms definite compound, the Glyco-cholate & tauro-cholate of albuminose, which adhere to bile. Bile not pure experimentitious fluid - only 210 hrs of 70% are bound

in feces: rest reabsorbed. Bile ar-
rests putrefaction & stops elimination
of feces. Arrests fermentation too.

(Feces infamously very offensive.) Amygd-
alin & Emulsin don't form prussic
acid if Emulsin is first exposed to action
of bile. A natural purgative.

Reaction immediately on articles of food.

{ Pancreas - Secretion Emulsifies
oil matter, rendering it fit for absorp-
tion. Mingle with starch forms first
glucose - added in small quantity
to taurocholate of albuminose it
dissolves it instantly & enables ab-
sorbent vessels to take it up.

(See pag 47 for composition.) "Water-
extract - albuminous - its pancreatin,
analogous to ptyalin & pepsin.
Process of digestion arrested in duo-
denum if pancreatic fluid is
prevented fr. being poured out.

Said by Sir Jas. Clark that in early phthisis
there is excessive acidif. of Alim. Canal
Secretions - pancreatic secretion being
acid don't emulsify fat & it enters into

blood is prevented - blood then seizes on fat of tissues; - when there is no more fat to be had, albuminous tissues ~~are~~ taken up & being deposited - causes irritation & tuberculous matter. H. Morrhua ^{Valpalis} hence relieves (this).

Nov. 23rd Composition of human faeces.

Water	— — — — —	75.3
Matter soluble in water	<div> <div> File — — — — — 0.9</div> <div>Albumen — — — — — 0.9</div> <div>Peutiar Extract — — — — — 2.7</div> <div>Salts — — — — — 1.2</div> </div>	5.4
Insoluble residue of the food.	— — — — —	7.0
" Matter which are added in the intestinal canal — mucus, biliary resin, fat & peutiar animal matter.	— — — — —	14.0
		<hr/> 102.0

Supposed by some that glands of Peyer are connected with lactical absorption - may be true, but they probably impart to faeces their characteristic odor. Ileo-cecal valve prevents the reflux of matter from large into small intestine - formed by two folds of intestine, lined with mucous membrane.

Leabificient digestion takes place
between pyloric & ileo-caecal valve.

{ Large intestine - We have circular
& longitudinal muscular fibres. The longi-
tudinal cause the puckering.

Has little to do with digestion. In herbivorous
animals an acid secretion is poured out
at upper part & sometimes in man, but
in the latter case it is supposed to be a
conversion of glucose into lactic acid.

It is a reservoir of feces. Very little
absorption takes place fr. large intes-
tine. Certain gases in intestine.

Gas of stomach consists of same
ingredients as atmosphere; That
of large intestine consists of Sulphu-
retted & Carburetted Hydrogen.

{ Gases may pass through wall of intes-
tine by endosmosis.

Characteristic odor due to a secretion
poured into intestinal canal & not
to putrefaction. Nature throws off
the food or alimentary matter which

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not being oxidized has a tendency to accumulate in the blood or alim. canal; hence diarrhoea often salutary & shouldn't be checked too soon in such cases. Support the strength of patient. Peristaltic action of int. int. Sometimes arrested - by obstruction in canal. Stercoraceous vomiting occurs - not fr. reversed peristaltic action, though this may possibly sometimes occur, but through a mechanical obstruction forcing it to the middle current upwards.

Defecation - Sphincter Ani muscle presides over act of defecation - voluntary & involuntary muscle. When fecal matter accumulates - the abdominal muscles contract, the glottis is closed, an inspiration takes place & we void the feces. (We should make it a habit to defecate at regular periods.) About 30 - passed per day, 3 1/4 solid.

{ Absorption - that function by means of which alimentary & other matters are taken up & carried into blood vessel system. Accomplished in vegetables by roots & leaves. In man by blood vessels & absorbents.

Nov. 25th Absorption - Ext.^l & Int.^l.
Ext.^l - Performed by skin & lining mucous
membranes. Int.^l fr. all portions of
body having no Ext.^l communication.
Ext.^l called also that of Composition,
fr. its going to furnish material.
Int.^l - that of de Composition - fr. its
removal of effete material.

~~Int.^l~~ Ext.^l absorption operation on Oleaginous
materials - called also Chyliferous
Lactaeal absorption - takes place
below orifice of pancreas & bile duct,
accomplished by vital action.


Intestinal villi - fr $\frac{1}{8}$ of a line to $\frac{1}{4}$ of an
inch in man - prolongations of mucous
membrane. Lactaeal vessel commenced
by closed extremity - in each villus - passes
through coats of intestine, beneath
peritoneum to mesenteric ganglia -
afferent vessels; Efferent vessels
run fr. here to receptaculum Chyli,
where thoracic duct begins - runs
up between azygos vein & aorta
to junction of left jugular sub -

clavian vein. Contents white & milky after eating oleaginous matter. Chyle consists principally of fat as found in afferent vessels - in efferent vessels consists of fat, albumen & fibrin - in thoracic duct has chyle corpuscles also. Mesenteric glands like Peyer's glands in composition - granular matter contained in cells. Chyle corpuscles at first $\frac{1}{4800}$ of an inch - later $\frac{1}{2800}$ of an inch in diameter - subsequently converted into blood corpuscles. Chyle has a tinge of redness in upper part of thoracic duct, for change going on into formation of blood corpuscles. Increase of fibrin & albumen in efferent vessels & comparative diminution of fat due to lymphatic vessels also emptying into mesenteric glands, conveying there the fibrin & albumen.

Whiteness of chyle due to oleaginous material emulsified by albumen - constitutes the "molecular base" of the chyle & is not dependent upon the presence of chyle corpuscles.

Entrance of chyle takes place through closed sacs. Villi flatten when alim. matter is not in canal, - Erect when food passes down - oligginous matter then absorbed & pass by endosmosis into lacteal vessel. These latter filled with transparent chyle in intervals of digestion.

(Amylaceous, Albuminous & saccharine matter taken up by blood-vessels by absorption & carried through liver.)

Thoracic duct terminates at a spot where it is least liable to pressure & where a "vis a fronti" will act on it - "Natural communication of fluid" -  There is also a "vis a tergo" caused by contraction of muscular walls.

The vessels have also valves - arranged like those of veins - giving a knotted appearance to vessels when distended. Chyle undergoes no change in its passage through the

thoracic duct. If its passage is prevented
Emaciation takes place, by entrance of
fat into system being thus obstructed
& passed off in diarrhoea.

Nov. 27th

Composition & properties of Chyle & Lymph.

Chyle — Lymph

Water — — — —

Albuminous matter (coagulable by heat.)

See Carpenter's Physiology
Page 153.

Absorption by bloodvessels. Bloodvessels of
stomach & intestines go through liver, where the
albuminous is acted on & assimilated; it
would be too irritating if carried immediately
To right side of heart. Billi of intes-

times abundantly supplied with blood-vessels which absorb alim. matter. Coloring matter thrown into intestines is found to be taken up by bloodvessels & not by lacteals.

Woovara poison, as well as that of Small pox & Rabies modifies the endosmotic power of gastric walls & is not absorbed fr. Stomach; Thrown into bloodvessels its poisonous effect is increased. Density of fluid influences rapidity of absorption - current taking place generally with greatest rapidity fr. rarer to denser liquid.

Lymphatics exist only in certain portions of the body - have cellular, muscular & serous coats; they have valves to prevent back flow - have ganglia & begin by closed extremities. Scarcely a trace of fat in lymphatics, they contain lymphatic corpuscles & their contents consist really of rudimentary blood. Absorption

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takes place more rapidly through them than through blood vessels, hence bulvers &c. They take up to effete materials capable of again being used by economy - as when more plastic material is thrown out in a tissue than is necessary for its nourishment.

Nov. 30th - Absorption Cont. Blood,

Men plunged into warm bath - absorb a great deal after losing weight by sweating &c. Cup of tea or a little wine will stimulate function of absorption which then take place rapidly fr. the whole surface. It takes place through blood - vessels in alim. canal, but through lymphatics principally fr. general integument. Hence nutritive injections & baths useful in some diseases. Can make skin absorb more rapidly by removing epidermis - the business of this prevents absorption of malarin & other poisons. Assaf. Garlic, Canthars,

Species reproduce their effect on being applied externally.

{ All animals have blood in their bodies.
Uses of blood - 3 - first, to carry
nutrition to all parts of body,
2nd To convey Oxygen for union with
refuse matter.

3rd To bring refuse matter to parts where
it may be eliminated.

(Body compared to Amsterdam - intersected
with canals - these last being blood vessels,
depositing different kinds of nourishment
at different spots & receiving refuse matter.)
Blood constantly varying in composition
in different parts of body.

Difficult to determine quantity of
blood in body - Can't do it by bleeding,
because heart stops beating for want
of force - Can't get it from decapitated
criminals because that last drawn
differs from first in having absorbed water.
Proff. Blake determines quantity
of blood in animals - by injecting a

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definite quantity of Alumina, Sulph. - then
draw so much blood & estimate the proportion
of Salt in it & by "single rule of three" found
out the quantity in whole body.

Quantity of blood in man about
 $\frac{1}{8}$ - $\frac{1}{9}$ of his whole weight.

Arterial blood on surface of body - bright
red; coming slowly fr. deep wound becomes
dark. Some invertebrata have white
blood. Red color in blood of leeches &c
exists in liquor sanguinis. Cases of
blue blood have been met with.

Women & especially pregnant women
said to have darker blood than men.
 CO_2 darkens blood. Prussic Acid
& Carbonic Oxide redden it. Sp. gr. 1055
in man - varies with quantity of Solids
or fluids. Sp. gr. regulated by perspiration
& absorption - by nature. When it goes
beyond 1057 - there is plethora - Anemia
when below 1050. Odor peculiar - depends
upon peculiar volatile fatty acids,
which is liberated by SO_3 - which

Separates it fr. its base & you then perceive the peculiar odor of the animal. No matter if the blood is dry on wood, stone &c, you can still perform this experiment successfully.

Temperature - 100° - 102° at heart, a very few degrees lower in extremities. Varies very little either above or below this. Temperature on both sides of heart the same, or possibly the right side higher than the left - not vice versa. (Bernard found right side $\frac{1}{2}^{\circ}$ higher) ^{carb. & trisacchar. of ferri} Alkaline reaction. Some materials would become solid in it if it were not. Menstrual blood rendered acid by acid secretion of vagina. Undergoes fermentation - zymotic diseases thus produced.

Sugar, water & yeast will ferment in veins - Animal becoming intoxicated by development of alcohol - if he don't die before it happens.

Composed of different ingredients.

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Liquor Sanguinis - Colorless fluid, having
red corpuscles floating in it. Exposed
to air - fibrin separates fr. Liq. Sanguis.
becoming solid, entangling corpuscles
forming clot, - the remainder of Liq.
Sang. forms Serum.

Approximate Analysis.

Albumen - 80

Fibrin - 3

Red particles - 127

Water & Salts - 790

1000.00

To get at mean analysis - draw $\frac{3}{4}$ in
one vessel - then $\frac{3}{4}$ in another - then
 $\frac{3}{4}$ more in the first vessel so as to
get at mean sp. gr. which varies at
different times. Allow the fluid in one vessel
to coagulate spontaneously; that in the other is
beaten with a small rod to separate the fibrin.
The products are then weighed, as directed in
Note - bottom of page 185 - Carpenter's Physiology.

Act 2nd Blood compⁿ

Living Blood contains certain Solid materials floating in it - Dead Blood has the fibrin & red corpuscles separated as Clot & the remainder forms Serum.
Blood cells or disks - composed of a vesicle, of globulin forming walls which allow endosmosis & exosmosis. Disk is flattened & bi-concave, Inside is haematin, coloring matter - distinct fr. the walls, as proved by water soaking through, bursting walls & allowing haematin to escape - leaving walls colorless. Has been supposed that the cell is homogenous in composition, not so. Haematin & globulin are albuminous in character. Corpuscles change shape by ex & endosmosis & by pressure - resume former shape on cause being removed. Color has been supposed to be due to prot or peroxide of iron; - the iron however does not exist so in blood - dilute acids not dissolving it; it exists as an independent element - as metallie

Iron & being discolored out by strong acid, the color is not removed. Origin of Corpuscles - supposed by some to increase by division like other cells; - they don't - loss of blood would not be so soon repaired. The white cells or Corpuscles fr. lacteals & lymphatics probably take the place or are converted into red corpuscles. They do so by liquefaction of their contents & undergoing peculiar transforming changes. They are first, as discharged into blood round or spherical & contain granular matter which disappears, leaving only one or two. Gradually these last disappear & the red color appears gradually enlarging - at the same time they become bi-concave.

There is no nucleus in white cell - such an appearance being due to refraction of light. The original blood cells are nucleated. Blood receives its Corpuscles fr. lymph & chyle.

When drawn fr. living body - a glutinous material exudes causing them to

adhere in vessels, - (as money used to do.)
Said that in inflam. a layer of fibrin of
considerable thickness is seen bet. each
pr. of disks.

The number of corpuscles diminished
in Anaemia & increased in plethora.
In exhausting diseases, the blood-corpus-
cles become serrated on their edges fr.
giving up their liquid. In giving up its
life the same thing is seen with a
change into a lighter color.

Uses of blood cells - Administer
largely to muscular & nervous
force, carry Oxygen to tissues & carry
 CO_2 out. After undergoing liquefaction
& retrograde metamorphosis they become
subservient to nutrition, by means of
their haematin, globulin, fats, salts &c.
A larger proportion of ^{phosphorus} fats & potash
salts than liquor sanguinis.

{ In their perfect condition they take
no part in nutrition.

This minute size & great number
admirably adapt them for carrying

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a large amt. of Oxygen to CO_2 from the System.
White blood corpuscles - fr. lymph
& chyle, which afterwards become converted
into red cells - Circulate on the outer
Side of the current of blood. They every now
& then send out a little process - granular
contents taking a current in one direction
or another & pushing out the wall whenever
it presses - giving rise to the opinion that
animalcules exist in the blood, which
is not the case in healthy blood. Size
of cell not in proportion to size of animal.
^(size of an inch in man) Disk of Mammals with one
^(Camel) exception, has circular outline. Blood
^{disk} of all animals hatched fr. eggs is oval
in outline. Fibrin - 3 parts in 1000. Easily
obtained fr. blood by stirring blood
as it flows & scraping it off fr. the instru-
ment used for stirring, composed
of $\text{C}, \text{H}, \text{N}, \text{O}$ & a little Sulphur & Phos-
phorus. Colorless when pure -
insol. in alc. Water & Ether. Sol. in
strong alkalis & kept in solution in
blood by alkalies in that fluid.

Coagulation Spontaneous. Add alcohol
 (?) vit coagulation. Coagulation of blood is
 a vital action, dependent upon vital
 & not mere phys. prop^s. Very low
 temperature prevents coagulation;
 high temperature facilitates it.
 Coagulates more rapidly when at
 rest than in motion. Multiple
 points of contact in containing
 vessel & Coagulat. is hastened.

Inflam. blood doesn't coagulate
 so rapidly. Atmospheric contact
 hastens it - hence takes place
 more rapidly in large than small
 vessel. Will coagulate in vacuo.

1000 parts of Liquor Sanguinis contains

Water	902.90
Solid residue	77.10
Fibrin	4.05
Albumen	78.84
Fat	1.76
Eph. matters	3.94
Min. Substances	8.33

Chlorine	3.644
Sulph. Acid	0.115
Phosphor. "	0.191
Potassium	0.323
Sodium	3.341
Oxygen	0.403
Phosph. of Lime	0.311
" " Magnesia	0.222

1000 parts of Red Corpuscle contains

Water	688.00
Solid residue	312.00
Hæmoglobin incl Iron	16.75
Globulin & cell membr.	282.22
Fat	2.31
Eph. Matter	2.60
Min. Subst. excl. of Iron	8.12

Chlorine	1.688
Sulph. Acid	0.066
Phosph. "	1.134
Potassium	3.328
Sodium	1.052
Oxygen	0.664
Phosph. of Lime	0.114
" " Magnesia	0.073

Dec 7th. Blood cont.

Inflammatory blood coagulates slowly, has a firm clot & buffy coat - the latter fr. the fibrin coagulating firmly at upper part of serum. The same thing occurs in pregnancy & anaemia - whenever the proportion bet. corpuscles & fibrin is disturbed it will be seen - the more you bleed the more you decrease the proportion of red corpuscles & increase relative amt. of fibrin - Old phlebotomy positively injuring coagulation of blood may take ^{place} internally - especially in right side of heart where aeration is impeded fr. various causes, or where a super-fibrinous condition of blood exists - as in persons who have lost a great deal of blood - if they then faint or the heart's action is arrested momentarily a fibrinous clot is apt to form in the ~~right~~ ^{upper} side of the heart. In pneumonia, pleurisy, ^{fibrin} rheumatism blood is super-fibrinous & often deposits itself on free margins of valves of heart - causing abnormal sounds like those of endocarditis. They may too be washed off into smaller ramification of arteries & constitute

embolism - Sometimes proving fatal, as
in cerebral arteries - or Senile gangrene
fr. stopping circulation in extremities.

Phlebitis may cause obstruction - by
products of inflam^{in veins}, or these Thrombi
or prod. of inflam. - Clots - may be passed
on to heart - be sent into lungs, causing
imitation, inflam. &c.

Cogulation once thought to be due to want
of warmth, but the latter rather ~~rather~~
hastens it. Thought to be due to atmos-
pheric presence - but it does so in
vacuo. Supposed to be due to some
substance wh. holds it in solution
in body - but why don't it do so out of
the body? Not due to it's remaining
at rest, because it does so when
in motion. Richardson supposed it
depended on the escape of Ammonia;
but it does so in the body & elsewhere,
where NH_3 can't escape - aneurisms,
valves of heart &c.

The cause doesn't exist alone in any

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of These, but in the presence of some substance
wh. has a tendency to become solid - it is
a vital process depend^t on the presence
of physical Aggregations - it is the last act
of vitalizⁿ of the part of the blood.

It is the only element of the blood capable
of pass^g from the fluid to the solid condition.
{ It probably is not the chief plastic element
of blood; - its small quantif^y - ($3\frac{1}{4}$ " - lb x $7\frac{1}{4}$ ")
would favor this supposition; again, it is
found that the fibrin of muscle & blood is
not identical. Again, when muscle is
at rest, instead of the fibrin decreasing it
increases & the opposite state of things exists
when muscle is exercised. Again, why
is it increased in wasting diseases & star-
vation? Besides, the blood of Carnivorous
Animals has less fibrin than that of
Ruminivorous animals; the fowler too
who requires so much nourishment - is found
to have little fibrin in its blood. Defibrinated
blood too is found to nourish the muscular
system. The fibrinous element seems

to be the poisonous element of blood as
proved by injecting the blood of one animal
into that of another - remove the fibrin
& the blood, in transfusion, is harmless.
(Brown-Sequard's Experiment with defibrinated
blood on criminals 8-10 hours after death
proved that it stimulated muscles to
contraction on Galvanic battery being
applied - the latter having proved useless
prior to injection of blood.)

Fibrin behaves like gelatin on treating
it with HCl ^(swells up) - it is useful in nourish-
ing tissues containing gelatin & in
arresting hemorrhage, as well as defining
& limiting the progress of pus in an ab-
scess & making a line of demarkation
bet. gangrenous & healthy tissues.

N^o 2 thinks fibrin is drawn out fr. wasting
tissues & the more the patient is starved,
bleeds, the more fibrin his blood con-
tains - when thrown out of the body
the last step in its existence is its
passage fr. a fluid to a solid condition.

Dec 9th. Fibrin cont. Albumen.

In animals bred "in tin" the fibrin increases; but de-
creases as the animal ^{advances} ~~increases~~ towards perfection,
while the red corpuscles increase.

Fat is not converted into albumen & fibrin.

{ Fibrin is derived fr. retrograde ^{metamorph.} ~~transformation~~ of living
tissue & goes to supply fibro-gelatinous tissues,
as well as limit inflam. action, Fracturing of
bones, gangrene &c.

Albumen - 70-80 parts in 1000. Derived
fr. digestive process; if food contains Nitrogen,
it is converted into albuminose & in the liver
into albumen. Not found in ex & secretions
in health. Not spontaneous, coagulable.

Dissolved in boiling H₂O. Nourishes
muscles - develops walls of cells. (fibrin
of muscles ^{more} nearly identical with Albumen than fibrin)

Supposed to exist in blood as albuminate,
generally of Soda; an acid takes away
this base & albumen is precipitated.

It is said that it holds in solution any mine-
ral substance injected into blood vessel -
as a solution of Cupri Sulph. which Copper
is removed fr. blood by the liver.

Its presence modifies the reaction ordinarily taking place bet. two chemical solutions - as Lactate of Iron + Ferro-Cyanide of Potassium - no blue color being formed. Add an acid here which coagulates the Albumen & the blue color is immediately formed.

Sometimes, by disease, drawn fr. blood vessels - as by rupture of capillaries, then appearing in uterine section & disappearing fr. blood, rendering the latter more fluid & causing anasarca &c. The blood is then, more easily thrown into vibrations, causing sounds, simulating abnormal sounds of valves. Relieve anemic condition & these sounds disappear.

All the organs of the chick developed fr. albumen, which is the chief plastic element of nutrition.

Fatty matter - derived fr. food.

Found in tissues. A peculiar fatty acid, with a peculiar odor in each animal, exists in blood; add SO_3 ,

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it volatilizes This acid, thus liberating the peculiar odor. Different kinds of food give rise to more or less fat. The molecular base of chyle is fat - ^{margin} dissolved by ether. The retrograde metamorphosis of fibrin gives rise to fat. Degeneration of muscle & albuminous tissues, is often fatty. Lungs & liver, being diseased, the fat often increases - as they generally eliminate it. It supplies material for generation of heat - being oxidized. It supplies material for nerve cells also - Consequently it is histopneumatic. In order that albumen may be assimilated it must contain fat. Salts - varied; each one has particular destination. Carb. & tris basic phosphates of Soda hold the various materials of blood in a fluid condition. In 1653 Transfusion of blood was first practiced - tried on dogs. In 1658 a Frenchman tried it on a madman; injected 3ⁱⁱⁱ of calves' blood & cured the man. He was again insane & being treated

in the same way, died under the operation.
Blundell revived it in Treating post-
partum hemorrhage & is now thought
very useful; The blood of a human
being is used & is defibrinated first.
Medicines have been thus used - re-
quiring smaller doses & acting more
powerfully & promptly. Hypo-dermic
injections probably act in this way.

Living.

Dec 7, 11th. Blood cont^d.

Sugar, Lactic acid, Urea, Uric acid &c
not subservient to constructive changes,
but result fr. metamorphosis - retro-
grade; their elimination being prevented
we have diseases of one kind or another.
The blood is a living fluid - having vitality
like that of muscles & nerves; has
power of develop^t itself out of dissim-
ilar materials - formative force's
manifested in development & growth,
the latter by the addition of fresh

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particles to itself, converting them into tissue like itself - this seen often in disease, as in insertion of vaccine virus - the blood taking on the diseased action, - all the materials of fermentation being then exhausted, a second introduction of this material doesn't affect it. It lives & grows as other materials of the body do & none possess this power in a higher degree than does blood. Recovers itself ~~to~~ normal condition after various diseases - by its self-maintaining power. Can see blood in 3 forms - 1st, passing fr. white into red corpuscles - 2nd, fully formed - adult life. 3rd, exhausted or worn out blood - old age. It undergoes development, growth & assimilation, & then decay. Crystals of haematoïdin - an albuminous substance - of a red hue - have been found in blood, - probably the result of a retrograde metamorphosis. (An oblong, rectangular form, sometimes rhomboidal.)

Respiration - that process by means of which ~~various~~ venous blood is converted into arterial - Oxygen taken in & CO_2 given off. An organic process, taking place in vegetables, as well as in animals. During Sunlight - Oxygen is given off by plants - digestion; as soon as the sun goes down, CO_2 is given off & O. taken in. Atmosphere kept pure by plants during day-time. Respiration removes CO_2 fr. system; CO_2 arises fr. constant decay of tissues; every thought, every movement, the exercise of every function gives rise to CO_2 . By increasing exercise, respiration is increased & more CO_2 given off. Oxygen introduced into system, unites with the fatty or hydro-carbonaceous matters, & CO_2 is formed. Every creature, no matter how low in the scale of animal creation is supplied with O & gives off CO_2 . Respiration takes place in lowest animals, by endosmosis of Oxygen through integumentary surface.

~~In~~ Higher animals with circulatory systems require an additional surface for oxidation; when this surface projects it is a gill; when it is seated internally, it is a lung.

In higher animals, the gills are folded, for furnish additional surfaces for exposure to water, for which O is absorbed, & the lungs too instead of being sac-like, are minutely divided. In insects the air is carried into the body by the blood, by means of ramifying tubes, called tracheae, opening on the surface by stigmata. Tracheae kept patent by a spiral arrangement on their surface. Fish takes in a mouth-full of water & spits it over his gills, where Oxygen by endosmosis, passes into blood; the Oxygen is taken from the air held in solution as it were by the water, & not from the decomposition of the water. The fish dies in air, because the gills become dry & endosmosis is prevented. Fish's heart is venous - sends blood to gills to be aerated; it is taken from here by branchial analogous to aorta.

Respiratory apparatus of Serpent is a long sac, of a cellular character, in expiration by muscular contraction, a hissing sound is produced; the surface is small & blood is freely aerated, hence the slowness of their movements. The gills or beard of the oyster is its respiratory apparatus - Snails have gills, so have lobsters, both working like fish's gills. In birds the air is introduced somewhat in the same way, as in insects, but they have also lungs, bound down to back of thorax; hence respiration in them is forced. They have also sacs (air-bags) covered with blood vessels, some in the interior of the abdomen & some even in the long bones, so that they can breathe through their bones - Can't easily sprangle them by hold^{ing} the trachea. They also exist under the skin, rendering the body light, so that the bird is capable of soaring a long time in the air without making a movement of its wings.

Sept 14th. Respiration cont^d - human.

Takes place here too to a certain extent fr. integumentary surface. Patients dying of pulmonary disease, tear off bed clothes in order to allow the atmosphere to reach the surface & thus take the place of pulmonary respiration - Oxygen being taken in by endosmose & CO₂ given off.

The parts engaged in respiration are, ^{the} bones of Thorax, Trachea, bronchi, air vesicles, combined to form lungs &c.

Trachea - tube extend^g fr. larynx to bronchi - cartilaginous rings, deficient behind, where they are connected by unstriated muscles, fibrous & elastic tissue. These muscles diminish caliber of tube in forced expiration, as coughing.

Fibrous & elastic tissue enables it to recoil after contraction. Mucous membr. continued fr. larynx. Bronchial tubes - branch off fr. trachea like branches fr. a tree; The terminal air vesicles forming the leaves. Cartilaginous rings have open space sometimes behind, sometimes before or laterally - keep tube patent. Unstriated muscles are arranged circularly - don't contract easily

under stimuli. Regulate the amt of air to be inhaled - Contracting when little air is required. Contract under fulvarism. Relax by the administration of Stramonium & Belladonna - hence these drugs useful in Asthma.

Mucous membr. cont^d fr. trachea & larynx. Cartilaginous rings & muscular fibres disappear when tube becomes $\frac{5}{8}$ of an inch; ciliated epithelium then disappears & becomes of the pavement character. They finally dilate into Air cells, whose walls are formed by same fibrous structure; thrown up into folds like honey-comb & opening into the inter-cellular passage, the opening in the int^d of the cells. Bloodvessels ramify over these folds & hence are exposed fully to the influence of the inhaled air. Said to be 600,000,000 of air vesicles in human lungs. Number increases fr. infancy to adult life, then decrease fr. breaking down of walls.

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Pneumonia is inflam. of these cells & the structure connecting them; soon filled up by plastic exudation, fr. such a number of bloodvessels ^{being} there located. Soon absorbed too, when effused. Previous to birth the walls are collapsed & in contact with each other - becoming expanded at first inspiration, except in cases of atalectasis pulmonis, where they do not dilate except under forced inspiration. A portion of air always remains in the lung & hence after being once inflated they will float in water. Lungs of child which never breathed are dark col^d, not light & expanded as far as pericardium, like lungs which have breathed. Take out lungs, larynx & trachea, so as blood shall not escape ligate vessels; if they float high in water it is probably the child has breathed. If they sink it is probably, but not proof positive the child never breathed. Putrefaction, giving rise to gas may cause them to float, but

putrefaction generally takes place here
last of all structure. Artificial
inflation may make them float,
but they are generally inflated at the
upper part & are not so heavy
as in naturally inflated lung.

If lungs, separated one fr. the other
will float & then cut into pieces
will still float, even after subjecting
them to pressure, you can swear
the child has breathed, but not that
the child ever lived, or was born alive.

A lung that has breathed is nearly
twice as heavy as a lung that never
breathed, giving rise to the test by
weight or "Static test".

460 - 600 gr - The weight of non-breathing ^{lung}
800 - 1000 gr " " " breathing lung.

but these do not always prove true,
is liable to variation & is given up.

Hydro-Static test is now the only
one relied on. Lungs covered by
pleura - divided into costal &

pulmonary pleura, a shut sac - the lungs on the outside. (The serous membranes are arranged thus with one exception, that of the female peritoneum, the Fallopian tubes here opening into it.) The sac must not contain air or the lungs collapse, if the orifice is large enough or if air is constantly pumped in. The surfaces move on each other noiseless, except in inflammation.

Dec. 16th Movements of Respiration

Inspiration - taking in air & Oxygen

Expiration - Send out air with CO₂.

Gentle Inspiration - Diaphragm principal agent - arched ^{relaxed} upward. when ~~relaxed~~ - nearly plane when contracted. Belongs to bellows movements & works somewhat in same manner as syringe is worked. Diaphragm is the only muscle concerned in respiration alone - paralyze it by cutting phrenic nerve & violent dyspnea & even asphyxia occurs. Deep inspiration in male more marked

" " " female "

at inf^r part of Chest.

" Sup^r " " "

Thorax increased antero-posteriorly in man, more at inf^r part by costal cartilages becoming straightened & pulling lower part of Sternum forward. "Inf^r costal type of respiration."

In female, first rib is more movable than in man, causing its rotation on its head & raising the thorax more Superiorly - "Sup^r costal type of Respiration".

150 lbs. Equals force exerted by muscles to overcome elasticity of bronchial cartilages & fibrous structure of lungs. 300 lbs. in overcoming elasticity of Thoracic walls; force altogether exerted = lbs 450.

Muscles of Inspiration

Direct Muscles { Scaleni; Intercostales; Levatores Costarum; Serratus posterior Superior; (mostly elevate the ribs) Diaphragm.

Indirect Muscles { Pectorales; (major & minor) Serratus Anticus major; Latissimus dorsi.

Aided by { Sterno-clido mastoid; Trapezius Rhomboides; Levator anguli Scapulae.

Persons who don't exercise upper portion of chest apt to have flat chests superior, & often atrophy of upper lobes of lungs; nutrition too is here impaired, morbid deposits taking place here preferably. Left lung more commonly affected because left side less exercised. Inflamm. more apt to take place at inf. & post. part because of greater functional activity & circulation here; right side being more subjected to congestion of liver, would perhaps account for frequency of pneumonia here. Expiration caused by return of parts previously put on stretch. Deep expiration caused by return of parietes of chest, costal cartilages & contraction of muscles attached to lower portion of body. From 16-20 inspirations per minute by adult - liable to variation; about 20 cubic inches of air taken in at each inspiration - thus calculate the amt per minute, hour or day - about 350 cubic feet during 24 hrs. This air becomes deteriorated by CO_2 , so that 300 cubic feet won't do to allow a man; 800 cubic feet is the smallest amt.

That can be safely allowed.

The "breathing volume" or "tidal volume" ^(20 cub. ins.) is this air taken in & given up ⁱⁿ ~~discharge~~ ^(180 cub. ins.) respiration. "Complemental volume" is what is taken in during forced inspiration.

"Reserve volume" - (100 cub. ins.) given out by forced expiration. "Residual volume" can't be forced out by expiration - 100 cub. ins.

"Vital capacity" affected by height, age, exercise of lungs, fat, weight, diseases of muscles, lungs, liver &c.

"Vital capacity" was applied by Dr. Hutchinson to that volume of air wh. can be expelled by living movements. 5 ft. - 5 ft. 1 in - 174 cub. ins. For every additional inch of stature bet. 5 - 6 ft., 8 additional cubic inches of air are given out by a forced expiration after a full inspiration. Weight - if the excess of weight depends upon corpulency (not upon increased height) the vital capacity decreases in a very marked manner.

Dr. H.

Dec 18th. Respiration Cont? (4 1/2)

About one respiratory movement to four ~~or~~ beats of heart in health; not invariably lower. Many diseases cause this ratio to be departed fr. Inspiration rather longer & more noisy than expiration - air is passed fr. larger to smaller tubes - more friction & opposition to its passage - Stand in the relation of 3 - 2 to one another & 1 will represent the period of repose bet. them. Evidence of disease when this proportion is departed from - Sign of tubercular deposit sometimes. Nerves govern them. Movements partly vol. - partly invol. partly under control of brain, partly of medul. oblongat. Pneumogastr. arising bet. Corp. olivaria & C. testiforme - distributed upon the ~~opposed~~ mucous membrane of bronch. tubes & walls of air vesicles. Spinal nerves & 5th pair also supply these organs. There is a reflex circle engaged in the act of respiration. An afferent nerve, a nerve centre & a motor nerve,

O_2 in the blood of air cells acts as im-
tant on Extrem- of Pneumogast. - Trans-
mitted to medull. oblong. & The motor nerve
conveys influence to muscles - Same
thing takes place in 3rd pair, distributes
to mouth & to Spinal Cord - filaments
of cph. go to intercostal muscles.

This reflex action regulates respiration
during sleep. Cold atmospheric air
act^g on new-born infant, causes an
inspiration as a Shower bath does on our
own bodies. Sometimes have to slap
child's nates to make it breathe, create
an excitation. (Use the same thing
later in life as a stimulant to virtue)
Cut pneumo-gastric - the movements
are reduced to one-half. The Spinal
Cord being cut in half the respiration
still goes on though feebly - phrenic
nerve cut - Still remains efforts
at respiration.

Wounds of Medulla oblongata - neces-
sarily fatal - it presides over move-
ments of heart & lungs.

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(Claude Bernard says a slight w^d in medul. oblong.
where pneumogast. is given off, causes in-
stantly an appearance of Sugar in urine,
fr. stimulating liver to increased action,
more Sugar being formed than can be
consumed as ~~Sugar~~ fuel by System;
R.D. - thinks you decrease number
of respiration movements & thus prevent
Sugar being consumed - not that Sugar
is elaborated in increased quantity.)

Medulla oblongata may be in a
soporose condition & thus suddenly
cause stoppage of respiration.

The sup-laryngeal branches of pneumogast.
are excit^r nerves - the inf^r laryn-
geal branches are motor.

Irritation in any part of alim. canal
may make impression on pneumo-
gast. wh. is transmitted to medul.
oblong. & other nerves are then caused
to act on muscles of larynx &c, causing
spasms, convulsions, Croup &c,
Man can't hold his breath long

enough to cause asphyxia.
Sighing, crying, yawning &c modifications of respiratory movements.
Sighing caused by intense occupation of mind, forgetting to breathe for a few moments - then a full inspiration is taken. Yawning is also a modification of inspiration.
Sobbing & hiccup - mod. of inspiration too - the glottis suddenly closing & the column of air striking against it.
Crying, laughing, sneezing, coughing, expiratory movements; air & half arches being contracted in sneezing.

Dec 21st. Respiration Contd

Condition of surround. air modifies amt. of air respired. A small amt of Ammonia added to air in respiration - Nitrogen perhaps a little increased in expired air. Ciliary movement assists in carrying Oxygen to smaller air tubes & removing CO₂ from them - That Counts

out moves along the walls of tubes. "Diff = 99
fusion of fuses" assists to a great extent.
Bronchial muscles have little to do with
its introduction. About 5% of Oxygen dis-
appears fr. air in inspiration; all the
Oxygen wh. disappears doesn't reappear
as CO_2 . There is a certain amt of CO_2 formed
in the blood, since Carbon & Oxygen both exist
in solution in that fluid. A lung when
cut into is found on test² with litmus paper
to be acid - fr. The presence of pneumonic
or pulmonic acid. Age, Sex, time of
day, qualif. of food - all influence amt.
of CO_2 in blood. From infancy to puberty -
steadily increases in quantif. - remains
stationary fr. 30 - 40; fr. then to be decreased.
It increases during Amenorrhoea attacks
of females. Gradual increase fr. mid-night
to midday & decrease fr. midday - mid-
night - due to the absence of sunlight.
Reposi¹ has a tendency to decrease amt.,
Exercise " " " " increase " "

The number of respiratory movements being frequent, a less quantity is given

off at each expiration, but the whole quantity is increased. It has been supposed that O went in & CO_2 out in the same proportion as they diffuse into one another out of the body. This is not a correct supposition however; they both vary with varying food.

Blood changes color in passing through lungs - thought by some to be due to the fact that haematin is naturally red & that this is increased in darkness by any acid, even CO_2 ; this is brightened by the salts of serum. It has been found though that this reddening won't take place without Oxygen.

It is said again that PO_5 is formed in blood, wh. unites with Soda & forms tribasic phosph. of Soda, wh. reddens haematin - this PO_5 being formed by O - conveyed by inspiration to Phosphorus of blood.

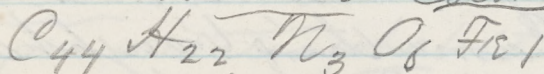
Others suppose that FeCO_2 exists in blood & that in breathing CO_2 goes off - the iron seizes Oxygen - $\frac{1}{2}$ vol.

99

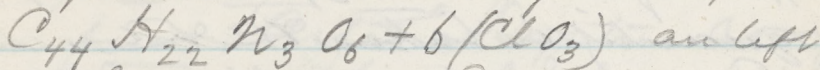
becoming Sesqui-Oxide wh. is of a very different color - making the color of blood depend upon presence of FeOCl_2 .

The color does not depend on the presence in the blood of iron, wh. does not exist as an oxide, but as Metallic Iron.

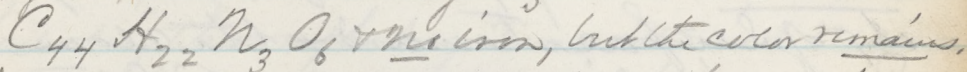
Blood-Coloring matter of -



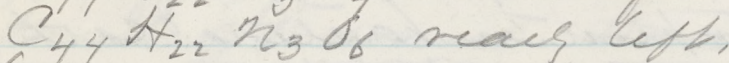
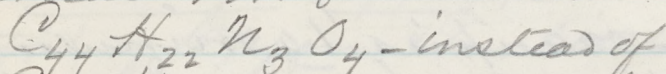
After passing Chlorine through the corpuscles



After digesting them with strong SO_3 we have



If iron exists as a Sesquioxide of hematin, weak acids ought to dissolve it out, & the residual iron-free matter should be



It (the color) is supposed to depend on different shapes of corpuscles, refracting light in different directions - not upon any change in chemical composition.

Dec^r 28th.

Life is put an end to when respiration is prevented - Commonly, but erroneously called asphyxia, since it means pulselessness, Apnoea better term - Cessation of muscular movement & circulation, with an accumulation of venous blood in the system; the same thing brought about by exposing man to CO_2 , so that a poisonous quantity is taken &c &c.

Asphyxia - Dyspnea - first Stage - fluidity of surface toward the close. Sensation disappears in 2nd Stage; these two stages occupy about 3 minutes. 3rd Stage - Circulation ceases - occupies 10 minutes.

High temperature hastens death.

Low " postpones it - hence cold-blooded animals resist it longer than warm-blooded. Interstitial changes diminished by low temperature - hence respiration is less frequent than because less oxygen is then required.

The residual air for a short time aerates
 The blood, when ligature is put around trachea.
 Animals submerged, three minutes, generally
 die. If put under water in a state of Syn-
 cope, or after a blow on head rendering him
 insensible, he may remain under as long
 as fifteen minutes. Pathological phenom-
 ena, no matter what the cause of
 Apnea, are - right side of heart & venous
 system full. Arterial system compar-
 atively empty. Blood loaded with CO_2
 circulating through system doesn't neces-
 sarily produce loss of consciousness.
 The latter is due in a great measure to
 The diminished supply, causing too small
 a supply of Oxygen & too little pressure.
Treatment of drowning. Don't roll pa-
 tient over barrel &c to get water out
 of lungs - it isn't there & you do violence
 to the last spark of life left in patient's
 body. Marshall Hall put patient on
 back - tongue held out & pillow under
 Epigastrium. Roll him a little
 beyond the middle of one side & then

back again - 15-16 times per minute.
Rub extremities upwards. Better not
use artificial insufflation - you
may tear the lung all to pieces
May put Ammonia or burnt feathers
under patient's nose.

Sylvester - Strips patient - draws
up arms over head & then depresses
them - 15-18 times per minute; at
the same time keep up friction
etc. If he were poisoned with H.S.
etc don't draw blood, as the endosmot-
ic power is stronger when vessels
are comparatively empty.

Deficient ventilation favors ac-
cumulation of excrementitious
materials in blood by prevent-
access of Oxygen; Zymotic dis-
eases then easily find a nidus.
It prevents elimination of CO_2 at
the same time.

Dec^r, 30th. Circulation.

That process by means of which nutrition is conveyed to every part of the body & effete material brought back for elimination.

An organic function - found in vegetables & animals; rudimentary in the former - takes place in cress. Ascend - higher, we find separate vessels for the circulation. Rootlets of Trees take up nourishment, & sky surface of leaves by decomposing CO_2 acts as a "vis a fronte". Have "capillary attraction" here too, as well as "vis a tergo". Fish has one ventricle & one auricle - The former sends it through the gills to be aerated.

Reptiles - 2 auricles & one ventricle.

Man has two auricles & two ventricles. The latter entirely separate from the former.

The Central organ is the Heart - lying behind sternum, extend^d a little to the right more to the left. Apex - junction of 6th. Costal cartilage with rib. Auricles at base. Ventricles form body & apex. Auricles receive ventricles proper blood; Auricles through Arteries held air - fr. being found empty

after death. Galen found they contained blood. Ancients thought & Galen taught that "Spiritous" blood was formed in heart - venous blood in the liver & that they were admixed in the heart, through communications bet. the ventricles.

W^m Harvey discovered Valves of heart, 1619 discovered it. In 1628 announced it to the public. Pulmonic Circulation Through Lungs. Systemic - Arterial Circulation, Through the body.

Heart possesses striated muscular fibre, but is not under control of the will. Fibres arise fr. base of heart & return there - contract equally in all directions.

January 4th 1844.

Heart grows in size fr. infancy to old age - hence the appearance of hypertrophy in old age. Nourished by Coronary Arteries not by the blood wh. passes through its cavities. Has distinct nerves - fr. Great Sympathetic & pneumogastric forming the

"Cardiac plexus". The enlargements on them are not distinct ganglia. Enclosed in Sacc, which lubricates it & keeps it fixed in position - The pericardium. Interior we have Endocard. continuous with membrane lining The blood vessels & similar to that lining chyliferous & lymphatic vessels. Sometimes called right & left heart - had better be called Ant^r & Post^r heart.

Average rate of heart's action

In the foetus in utero	140-150	Beats per minute.
Newly born infant.	130-140	
During the 1 st year	115-130	
" " 2 nd "	100-115	
" " 3 rd "	95-105	
From the 4 th to the 14 th year	80-90	
" " 14 th " " 21 st "	75-85	
" " 21 st " " 60 th "	70-75	
Old age	75-80	

Alternate contraction & dilatation of auricles & ventricles - ^{Corresponding} Cavities of ^{Equal} Sides ~~contract~~ contract simultaneously - Diastole & Systole. Heart must have period of repose - This period occurs immediately after every contraction of auricles & ventricles. Contraction begins in right auricle.

riole, followed by contraction of right ven-
tricle - then follows short period of repose.
Contraction rapidly extends over whole
heart. About $\frac{1}{3}$ sent out from each
ventricle at every systole. Takes about
 $1\frac{1}{3}$ minutes for a particle of blood to make
the round of the circulation. Impossible
to estimate the force of heart's contraction
in man accurately; probably heart pro-
pels blood with a force equal to $4\frac{1}{3}$ lbs.
Every part of the int^l of the ventricle, equal
to the size of the aorta's area, bears a
force equal to $4\frac{1}{3}$ lbs - The whole force
{ sustained by the ventricle is equal to
{ 57 lbs. Cause of heart's action - Sup-
posedly some to be due to the presence
of blood in the heart; This is true to
a certain extent, but it takes place
after all the blood has been removed
fr. it - even after removal fr. the body.
Has been supposed by Lee & others to be
depend^t on the presence of the nerves wh.
supply it - but, it continues after removal
fr. the body, & the little bodies surround^g

it are not real ganglia.

We find it taking place in The Embryos, before The nerve, or muscular fibre is developed, when the heart is a mere mass of cells. It is influenced by the nerves, but not dependent upon it. (Rider on horse back.) Carpenter thinks it dependent on excessive contractility - or mobility of The muscular fibrils, the result of previous acts of Nutrition - becoming sur-charged, it discharges itself as an Electric or Leyden jar does. But The muscles of heart are less easily stimulated To contraction by Electricity after death & we see no such thing in any other muscle. Brown-Sequard thinks it depend- upon The presence of a certain excitant (Cl_2) in The blood which acts on The muscular fibrils of The int^l of The ventricles.

See The Trachea of an animal & open The abdomen & we find The movements of The heart are increased, in force & frequency & The peristaltic action is

increased. Hold your breath & you observe the same thing in the heart's action — Proofs of CO_2 being an excitant in small quantities. In large quantities it is undoubtedly dedative.

The Rhythmical action of the heart is due to the fact that the contraction is caused by CO_2 being sent into substance of heart during dilatation through coronary arteries — during contraction of ventricles blood is prevented from entering by these arteries & hence the stimulus to contraction is not kept up.

Lau. 6th. Sounds of heart & attendant phenomena.

- | | <u>Causes</u> | <u>Phenomena</u> |
|-----------------|---|--|
| 1 st | Rush of blood through auriculo-vent. orifices. Impulse; Rush of blood through orifice of aorta & pulm. art. Sound of muscular contraction; collision of blood particles | Auricles contracting, ventricles dilating & contracting. Pulse & impulse, auricles dilating. |
| 2 nd | Shutting down of sigmoid or semilunar valves | Ventricles dilating, auricles dilating |
| | <u>Interval of repose</u> | |
| | Auricles distended, ventricles dilating. | |

CO_2 is a stimulant to muscular contraction. Dr. thinks even contraction of Uterus at end of gestation, is due to CO_2 . There is a certain amount of excitability in the Uterus then, called into action by CO_2 in the blood. Fortius expelled after death of Mother by CO_2 causing uterine contraction.

Persons who are hung are apt to have discharge of penis & seminal liquor fr. accumulation of CO_2 causing muscular contraction - respiration & hence its escape fr. The body being prevented. CO_2 also excites nervous tissue to action. Why does heart alone present rhythmic motion? It doesn't - muscles of face & diaphragm may do so in asphyxia. First; The amt. of irritability-resistance to the heart's action is less than other muscles, hence its greater rhythmic action under an equal amt. of irritant or excitant.

(See page 105 for average rate of heart's action.) As individual grows older & muscular power diminishes

inishes, The heart has to work faster
to accomplish the same amt. of work,
Impulse - The striking of heart against
chest - felt best in thin waisted chests,
at 5th intercostal space - bet. left nipple
& side of sternum. More or less dis-
placed by change in position & res-
piratory movements, as well as by effu-
sion into pericardial sac & into plu-
ral cavity. Cause of impulse thought
by some due to systolic action & projec-
tion of apex against walls of chest.
But, heart being hollow, must contract
in every direction in Systole, hence it
becomes smaller. In hypertrophy too,
there is only increased impulse, when
the auricles too are hypertrophied.
D^r thinks the impulse is dependent upon
the Diastole, The ventricles then in-
creasing in size. In thin persons you
can feel two motions - 1st due to the
dilatation of the ventricles & second,
{ The gradual turning up of the point
of the heart during the contraction of

111

The ventricle. You don't feel a pulsation at the wrist, correspond^g with each impulse of the heart - it sometimes takes several contractions of the auricle to fill the ventricle & it is those we feel. There is forcible dilatation of the auricle, during the contraction of the ventricle. (See Wood's Practice.)

Q - heart Sounds - 1st & 2nd. First prolonged, 2nd short. (See Causes of heart Sounds - page 108) By pinning back the semilunar valves the 2nd sound is prevented.

Quincy.

Quincy. Pth.

Passage of blood through aorta & pulmonary artery, cause principals the first sound. 2nd sound heard best bet. 3rd & 4th ribs. The direction of abnormal sounds indicates the valves diseased. Arteries carry blood from heart - called arteries by arising fr. being supposed to carry air. Ex^t coat of artery is made of cellular material,

which supplies bed for "vasa vasorum"
& adds strength to coats. 2nd Coat - Contains
Elastic material which is displaced
by unstriated muscular fibre at some
distance from the heart - proved by chem-
ical tests to be muscular fibre. Mechan-
ical stimuli or Electricity will cause it
to contract. Cold contracts it & heat relaxes
it. Serous Coat - 3rd - Continuation
of that lining heart - cut through with
the middle one by the application of a
ligature. Pours out a secretion which
lubricates the int^s.

Greater elasticity of Arteries near heart
prevents the force of blood there fr. rupturing
the vessels & the recoil causes valves
of aorta & pulmon. art. to shut down
& prevent reflux of blood - prevents
the flow of blood too fr. being interrupted;
keeps up a cont^d stream - allows for
the vessel to be bent in every direction,
as in the varying positions of our limbs.
Muscular fibre has nothing to do

with forcing the blood through the vessels, but under the influence of Sympathetic filaments - they regulate the amt. of blood passed through them in proportion to the wants of the system.

During lactation, the blood vessels of mammary gland dilate to allow more blood to pass to gland - becoming smaller, contracted again to normal size, at end of lactation. Same thing takes place in uterine vessels during pregnancy. A net of muscular fibre regulates the tonicity of the arteries. The sum of the diameter of the branches is greater than the diameter of the parent trunk: We must compare the sums of the squares of the diameters, which will make the difference bet. the area of the branches & that of the parent trunk, less than was at one time supposed.

Arteries are increased in transverse diameter, as well as in length at each pulsation of ventricles. They arise from this bed in consequence of this

elongation - causing the pulse - felt at wrist & elsewhere. Every contraction of ventricle throws out $\frac{1}{3}$ forming a "head-wave", when the elongation or dilatation of the artery occurs simultaneously with the flow of this "head wave" we have a regular ordinary pulse. Dischrotic pulse when the "head wave" is felt before the dilatation of the arteries, fr. want of tonicity in arteries.

The pulse

indicatis	by	it is called
1 st The strength of the contraction of the heart.	Strength -	Strong
	Weakness -	Weak.
2 nd The quantity of blood thrown out at each contraction.	Fulness -	Full
	Smallness -	Small.
3 rd The number of contractions	Frequency -	Frequent
	Slowness -	Slow
4 th The regularity of its action as to strength, quantity or frequency	Regularity -	Regular
	Irregularity -	Irregular
5 th The degree of the <u>tonicity</u> of the arteries	Intermission -	Intermittent
	Hardness -	Hard
	Softness -	Soft
6 th The irritability of the nervous system	Redoubting -	Redoubting
	Trembling -	Trembling
	Quickness -	Quick
	Larking -	Larking

Jan. 11th ^H.

When the dichrotic pulse is felt there is a necessity for stimulants.

Female pulse - 8 or 10 beats more frequent than male. More frequent in month, than even, & more easily affected by stimulants in the month. There is an increase in frequency fr. midnight to mid-day - decrease fr. mid-day to midnight. Ordinary daily fatigue exhausts the heart. Food increases frequency, so does exercise. Pulse varies in the standing or lying position 10-15 beats.

More muscular effort required to maintain the body in the upright, than in the sitting or recumbent positions hence "diff. pulse".

When heart's action is abnormally increased, as in the irritative state of commencing or declining phthisis, "diff. pulse" is not observed.

Rate of movement of blood through arteries - about 1 ft. per second.

Capillary System - fr. Capillus, a hair - fr. their small size. Arteries lose first their cellular, then muscular, then int^l elastic coats, & homogeneous coat alone is left - vessels

caliber

become capillaries. Harvey thought arteries emptied blood into channels veins collected it fr. them. Capillaries not fixed in their disposition. No pulsation in them. Rate of movement of blood - $\frac{1}{10}$ inches per minute. United Caliber fr. 300-400 times greater than that of arteries - length not so great however. Nutrition, Secretion & phenomena of living tissue take place here. Every organ has its peculiar capillary arrangement - peculiar to muscle, intellect, skin &c., so that the tissue may be told by the arrangement of the capillaries. Two capillary systems usually described - pulmonic & systemic - to wh. may be added portal & renal - making in all four.

Don't find any evidence of structure, except here where a nucleus, fr. wh. lost tissue is repaired.

There is inherent capillary power in these vessels, causing circulation through them after heart is excised. An acardiac foetus

is known to live in utero, though it dies at birth. Stimulation of frog's foot, & circulation is increased without change in rate of heart's action - same case with Saliva in the mouth, & human breasts.

What causes independent capillary circulation? There is an affinity bet. the tissues & the constits. of the blood; as soon as one particle is deprived of its Oxygen or nutrient principle it is pushed on by other particles attracted in the same manner as the first. When there is an increased demand for blood the arteries take on increased action. Capillaries detain the blood for the purposes of nutrition.

Active & passive hyperaemia are better terms than active & passive congestion.

The first caused by too much blood flowing to a part, The second, by too little flowing out. Obstruction causes the latter, and leaking or effusion of the watery elements takes place - in rare cases the plastic

Elements - albumen & fibrin are effused.
Sometimes have hemorrhage fr. rupture
of the walls - used to be thought the
corpuseles soaked out.

Some parts more liable to passive hyper-
aemia than others - lower extremities - por-
tal System becoming obstructed. It does
not conduce to hypertrophy - rather to
atrophy - because the blood is venous
& non-nutritive. Congestion may so
weaken the vessels that they will re-
main enlarged.

Whenever the molecular changes are in-
creased in activity, there is an increased
apflux of blood - "active hyperaemia";
The heart does not cause it directly -
"ubi irritatio &c. This will occur en-
ting independently of nervous influence,
under any stimulus.

End of Vol. 1st.

Examined by W. Smith on
The Uses of the blood.

Its most important ingredient.

Fermentation in the blood.

The cause of the heart's sounds.

The arrangement of its muscular structure.

The relative thickness of the two sides of heart.

Quantity of blood sent out at each contraction.

Forces propelling blood through system.

Use of the elastic tissue in coats of arteries.

Essential conditions of life.

Molecular death.

Peculiar property of muscle.

" " " " Nerves.

" Shock."

The amount of blood in the body.

The cause of the pulse.

University of Pennsylvania

Jan 8th 1864.

Francis G. Smith Jr

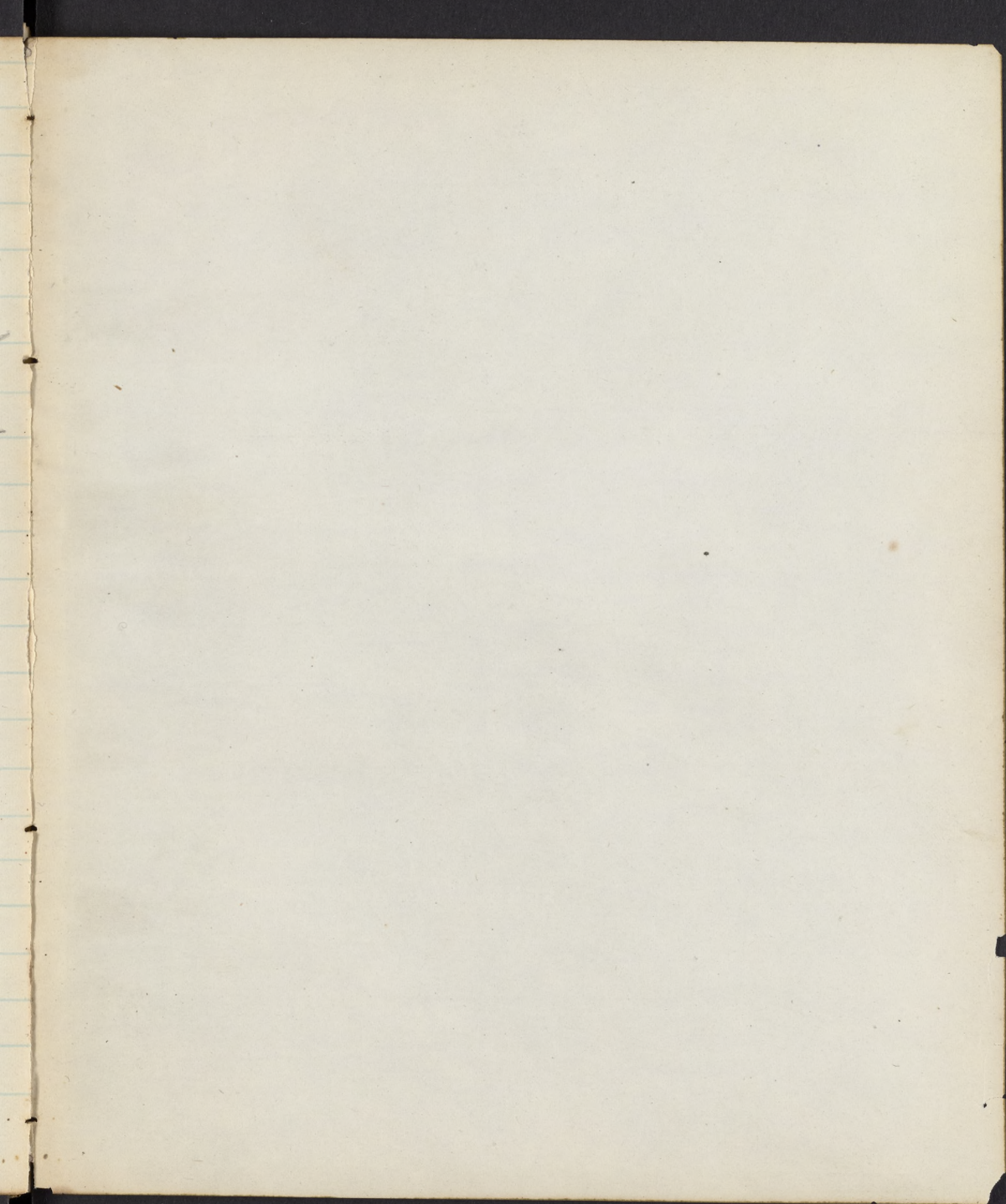
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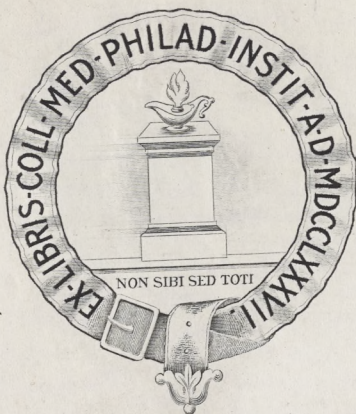
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